2019

Dynamic Macro-Economic Analysis of an Oil Price Shock, Fiscal, Monetary and Exchange Rate Policies for Libya in the MENA Region

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A Dynamic Macro-Economic Analysis of an Oil Price Shock, Fiscal, Monetary and Exchange Rate Policies for Libya in the MENA Region

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This thesis is presented as part of the requirements for the award of the Degree of Doctor of Philosophy (integrated) of the University of Wollongong/UOW

UOW Australia

Faculty of Business

School of Accounting, Economics and Finance

August 2019

Abstract

Resource abundance should play an essential role in the economic growth of Middle East and North Africa (MENA) countries. However, whilst Libya is one the largest oil-producing and exporting countries in the MENA group, reliance on oil has had adverse impacts on non-oil sectors, resulting in a prolonged periods of slower economic growth and high inflation. Hence, reliance on plentiful oil reserves may be more of a curse than a blessing for Libya.

This study focuses on the 'Dutch disease' component of the resource curse, whereby considerable foreign-currency-denominated revenue from oil exports has appreciated the real exchange rate, ensuring loss of competitiveness of domestic non-oil exports. Domestic inflation has also resulted from these developments. This is particularly noticeable for Libya that is the focus of this study.

The thesis provides a historical review in Chapter 2 of oil development and its broader influence on key macro-economic variables and policy in the Libyan economy. This chapter reviews six periods from 1950 to 2016 that include the pre-oil era, periods of boom and volatility, economic sanctions, uprising and civil war. Chapter 3 reviews the relevant theoretical and empirical literature, noting the emphasis on developed resource rich economies. The review of empirical literature focuses on exchange rate appreciation and spending effects of Dutch disease, and how macro-economic policies react in this context. In doing this, a research gap is identified. The current study attempts to fill this gap by examining linkages of monetary policy to Dutch disease using two views: Corden's (2012) and the monetary policy Taylor rule (1993–2011). Chapter 4 extends the Cox and Harvie (2010) macro-economic model to characterize Libya as a small, open, oil exporting developing economy. This dynamic model is used as the theoretical foundation for the empirical analysis in Chapters 5, 6 and 7.

The SVAR simulations in Chapter 5 using available Libyan yearly data from 1980 to 2016 provide clear evidence of the Dutch disease. Under the Libyan managed exchange rate regime, a world oil price shock adversely affects real non-oil output and the domestic

price level in the short to medium term. Chapter 6 introduces the role of fiscal and monetary policy under a fixed exchange rate. The simulations show the Corden (2012) recommendation is valid in that a real fiscal budget surplus overcomes Dutch disease effects and the twin deficits problem. However, lowering the domestic interest has very little effect on real non-oil output, whereas a direct depreciation of the nominal exchange rate is more effective.

Fiscal and monetary policies are further analysed in Chapter 7. The main conclusions of the dynamic simulations are that Libya needs to redirect fiscal expenditure away from consumption and towards strategic investment spending. This long-term strategy should aim to improve productivity in the non-oil sector and reduce inflationary pressure. Second, in the case of a world oil price shock, consistent with Corden (2012), the appropriate short-term fiscal response is that increased fiscal spending should be designed to reduce public consumption spending and move the fiscal budget towards a surplus. Third, a Taylor rule should be used as the basis of short-term monetary policy to limit the increase in the nominal interest rate and counter the appreciation of the flexible nominal exchange rate. This coordination of these instruments will reduce Dutch disease effects in the short to medium term, and help achieve stable prices.

These findings are significant because they provide unique and evidence-based policy prescriptions. This study, although focusing on issues for the Libyan economy, has relevance to other oil-exporting countries in the MENA region, and more generally for other resource-exporting developing countries.

Acknowledgements

First, I express my sincerest gratitude and appreciation to my supervisors (Associate Professor Ed Wilson, Associate Professor Charles Harvie and Dr Celeste Rossetto), who have provided ongoing support and encouragement throughout the preparation of this thesis, through their advice, recommendations and constructive comments. Their comments, recommendations, creative suggestions and encouragement have been invaluable, and this thesis would not have been completed without them. I am thankful for their academic guidance, which encouraged me to achieve high levels of quality research.

A special thank you to the Central Bank of Libya staff members who assisted me and introduced me to the data I required for my empirical analysis. I also extend my sincere thanks and deep appreciation to all academic and administrative staff in the Faculty of Business at University of Wollongong who have supported me in many different ways during my study.

I would like to thank my beloved parents, brothers, sisters and friends for their emotional and financial support, and prayers. I appreciate the support and encouragement that enabled me to complete my study. I am also grateful for the coverage of the cost of daily life because of the circumstances of the civil war in my country and delays to the payment of my scholarship from the Libyan government.

Finally, I really appreciate all other support provided to me during my study.

Certification

I, Warda T I Alsaiaf, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy (integrated), in the School of Accounting, Economics and Finance of the Faculty of Business, University of Wollongong, Australia is wholly my own original work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Warda T I Alsaiaf

31 August 2019

Dedication

This dissertation is dedicated to my family (particularly my older brother Muftah), who have supported me in the completion of my study. Also, I dedicate this thesis to all my friends, both in Libya and overseas, my supervisors, and my faculty, who have been valuable assistants to me along the way.

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List of Abbreviations

AOECs	African oil exporting countries
AIC	Akaike information criterion
ADF	augmented Dickey–Fuller
ARDL	autoregressive distributed lag
BoP	balance of payments
CPI	consumer price index
NDISRATE	domestic nominal interest
DFF	domestically investing future fund
DSGE	dynamic stochastic general equilibrium
FFR	Federal funds rate
FPE	final prediction error
FDI	foreign direct investment
GDP	gross domestic product
GCC	Gulf Cooperation Council
HQ	Hannan-Quinn information criterion
IRF	impulse response function
IMF	International Monetary Fund
LM	Lagrange-multiplier
LYD	Libyan dinar
LNOC	Libyan National Corporation
MENA	Middle East and North Africa
MCI	monetary condition index

NOC	National Oil Corporation
NEXR	nominal exchange rate
NDISRATE	nominal interest rate
NMONS	nominal money supply
OLS	ordinary least squares
OPEC	Organization of Petroleum Exporting Countries
PP	Phillips–Perron
PPP	purchasing power parity
REXMP	real effective exchange rate
REXN	real exchange rate
RFSB	real fiscal budget balance
RGDP	real GDP
GOVCONS	real government spending for consumption
GOVINV	real government spending for investment
RNOGDP	real non-oil GDP
RNOTRD	real non-oil trade balance
RPRIVCON	real private consumption
RPRIVINV	real private investment
SC	Schwarz information criterion
SWF	sovereign wealth fund
SFVAR	structural factor vector autoregression
SVAR	structural vector autoregression
TRGS	total real government expenditure
TNC	Transitional National Council
UIRP	uncovered interest rate parity

UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
US	United States
VD	variance decomposition
WOILP	world oil price

Chapter 1: Introduction

1.1 Background and Context of the Study

For many developed and developing countries, natural resources are considered a key factor in promoting real economic growth (Smith & Krutilla 1984; Carneiro 2007; Auty 2001; Angrist & Kugler 2008). Natural resources have contributed to a rapid increase in the development of countries such as the United States (US), Canada and Australia (Carneiro 2007; Ali 2011). In these countries, particularly in the early stages of development, the massive revenue from natural resource endowments contributed to improving the non-resource sector through expenditure on physical infrastructure, education, health and enhancement, manufacturing and improved productivity (Carneiro 2007). There was a development of backward and forward linkages with the resources sector, which facilitated a diversification of these economies' economic base. However, for many resource-abundant economies, these linkages never developed and the economy remained narrowly based on the resource sector and remained vulnerable to resource price volatility and deteriorating terms of trade. More recently, many natural resource-rich developing countries have endured low, slow economic growth and high inflation during their period of resource production. This is linked to the resource curse issue, especially Dutch disease. Many nations from the Middle East and North Africa (MENA),[1] Central Asia (including Azerbaijani, Uzbekistan and Turkmenistan) and Latin America (e.g., Venezuela and Mexico) rely on the natural resource sector (such as oil and gas) to contribute to real output. They are likely to be more susceptible to lower growth and higher inflation than other developing countries with more diversified economic structures (Auty 2001; Angrist & Kugler 2008; Al-Saqri 2010; Andrade 2017).

Thus, the benefits from the abundant resources are not likely realised yet. Instead, the endowment of natural resources has resulted in poor economic performance, not high

[1] Most MENA countries suffer from Dutch disease. This issue is significant in Libya, Algeria and Oman, who rely largely on the oil sector and are more affected by oil prices than other MENA countries, such as the United Arab Emirates (UAE) (IMF 2014; Fargani 2013; Al-Saqri 2010). Economic diversification in the Gulf Cooperation Council (GCC) helps it reduce the adverse impacts of oil price shock.

economic growth (Ndikumana & Abderrahim 2010). This has been explained as the so-called 'resource curse' effect. According to Auty (2003), the resource curse indicates a linkage between the abundance of oil and poor economic performance. The existence of resources does not guarantee benefits since there are no efficient policy choices to manage resource revenue (Usui 1997). Thus, the abundance of natural resources can appear as a 'curse' rather than as a 'blessing' (Sachs & Warner 1997; Gylfason 2001a; Auty 2004; Hasanov 2013; Smith 2015). The resource curse includes factors related to decision-making effects such as poor governance and weak institutions, corruption and rent-seeking behaviour (see Chapter 3). The resource curse also includes macro-economic effects, which belong to the Dutch disease effect.[2]

For example, in developing countries with few natural resources[3] (e.g. the Asian tiger economies—South Korea, Singapore, Hong Kong, Taiwan, and before these Japan), their economic growth performance was better (Sachs & Warner 1997; Auty 2001). South Korea, Singapore, Hong Kong and Taiwan experienced high average annual real GDP growth rates of 7.4%, 7.3%, 4.9% and 6.0% respectively during 1990–2016 (International Monetary Fund [IMF] 2018; World Bank 2018). While countries with plentiful natural resources (including oil) like Algeria, Nigeria, Venezuela and Azerbaijan, experienced average annual real GDP growth rates that were lower (3.4%, 3.3%, 2.6% and 3.5% respectively) during the same period from 1990–2016) (World Bank 2018). The average annual GDP growth rate has not exceeded 4.5% for oil-exporting MENA countries such as Libya, Algeria and Kuwait during 2000–2016, subsequently declining sharply to less than 4% in recent years (World Bank 2016; see Figure 2.5). The situation

[2] The term 'Dutch disease' came from the discovery of natural gas in the Netherlands in the late 1950s. Major production arose in the early 1960s, giving rise to readily observable, adverse effects on Dutch manufacturing throughout the 1960s.

[3] Most of Korea's natural resources are located in the North and with the partition of the country in 1953, at the end of the Korean War; the South had very limited natural resources with which to develop. When the South engaged in the heavy and chemical industries (HCI) industrialization drive during the 1970s, they had to import raw materials such as iron ore and coal for steel production. Japan has very limited natural resources and has been heavily dependent for its industrialization on the importation of natural resources such as coal, oil and gas. Taiwan's economic development strategy was based on the development of SMEs in the light manufacturing sector, and not heavy manufacturing, due to limited domestic natural resources. Singapore and Hong Kong, being city states, have very limited natural resources and are heavily dependent on trade, light manufacturing and services (financial and tourism) for their development.
For more information, see the websites below.
https://www.worldatlas.com/articles/what-are-the-major-natural-resources-of-south-korea.html
https://www.worldatlas.com/articles/what-are-the-major-natural-resources-of-taiwan.html
https://www.worldatlas.com/articles/what-are-the-major-natural-resources-of-japan.html
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https://www.worldatlas.com/articles/what-are-the-major-natural-resources-of-hongkong.html

is worse in Libya, where economic growth has remained low from 1980 to the present. As shown in Figure 2.5, the average annual real GDP growth rate was small, approximately 4% during 2000–2010; it declined sharply to less than 4% during 2011–2016. (World Bank 2014) because of the civil war and its aftermath. Subsequently, average inflation rates ranged from 10–22% during 2000–2016 (World Bank 2014). Conversely, the average inflation rate has ranged from 8–22% during 2000–2016, especially for countries with higher spending effects of Dutch disease, such as Libya and Algeria (IMF 2014, 2016; Lahreche *et al.* 2014).

In Libya, the presence of natural resources such as oil can affect the rest of the economy negatively when oil revenue is not transferred to non-oil traded sectors (Ahmouda 2014). Thus, unemployment has remained at a high level in Libya, at least 30% on average, over 1990–2014 (Central Bank of Libya 2014; African Development Bank 2012, 2017). This higher unemployment rate is associated with the absence of a strong private manufacturing sector and low economic growth in the non-oil sector, which is an outcome related to Dutch disease (Edwik 2007; Alimohamed 2014). The economic base of Libya is narrowly focused on the oil sector, leaving other sectors neglected or lacking in competitiveness due to the strong real exchange rate and limited investment by the government. Consequently, the economy is vulnerable to external shocks, such as oil price shocks, that affect economic stability, especially in terms of real GDP growth and inflation (Edwik 2007; Harvie & Ali 2013). Therefore, it is imperative to explore the impact of oil prices on the domestic economy and analyse the consequences and effectiveness of macro-economic policy responses in this context.

The macro-economic and policy effects of the resource curse linked to Dutch disease is the main issue in oil-exporting MENA countries (see Chapter 3), such as Libya, Oman and Algeria. These countries have reported considerable increases in revenue from rising resource prices, in particular during the 1970s when oil prices increased significantly. Revenue increases have also resulted from the discovery of further resources or technological progress in the oil sector. This has led to increased oil production, which forms the basis of Dutch disease. Adverse effects occur through the transfer of capital, skilled labour and technology from the non-oil exporting sector to the oil exporting sector. This can arise through resource movement or spending effects

(Corden 1984; Corden & Neary 1982; Stijns 2002, 2005; Andrade 2017). For example, increased wages and returns to capital in the oil-exporting sector can lead to a movement of the economy's productive factors from the tradeable goods sector to both the non-tradeable goods and natural resource sectors. This is called 'resource movement effect' (Corden 1984; Corden & Neary 1982). Resource movement occurs in countries where the resource sector is factor intensive in capital and skilled labour, causing these factors to move in substantial amounts from the non-resource to resource sector, resulting in a decline in the tradeable non-resource sector. Domestic capital and skilled labour are likely to be scarce in MENA countries, so labour would have to come from overseas. Therefore, the impact of the resource movement effect in the domestic economy will be small. The accumulation of wealth from these developments in the resource sector can lead to booming demand due to the spending effect, which arises from the large economic revenue generated from oil production (Stains 2002, 2005; Andrade 2017). Hence, the spending effect is likely to be more important in MENA countries.

Increased wealth due to higher revenue and increased government spending from oil and gas exports have led to an appreciation in the real exchange rate. Subsequently, the manufacturing sector's output and exports have become less competitive in international markets. This issue subsequently became the focus of considerable economic research (Corden & Neary 1982; Buiter & Purvis 1983; Corden 1984; Wijnbergen 1984; Harvie 1993; Sachs & Warner 1997; Rosenberg & Saavalainen 1998; Bénassy-Quéré et al. 2007; Chen & Chen 2007; Lizardo & Mollick 2010; Cox & Harvie 2010; Tiwari et al. 2013; Rudd 1996; Andrade 2017).

In Libya, the labour employed in the oil sector is mostly skilled, consisting of foreign workers who have little impact on domestic labour markets. Thus, the resource movement effect in Libya is likely to be limited. It was suggested that the Libyan oil sector has had little requirements in terms of domestic factors of production (Ali 2011). Therefore, the spending effect is expected to be more important than the resource movement effect[4] for the Libyan economy (Ali & Harvie 2015a). The substantial revenue from oil and a lack of appropriate macro-economic policies to accommodate this,

[4] See Section 3.3 for more information on Dutch disease, spending and resource movement effects.

specifically fiscal and monetary policies, feeds inflation more than economic growth does because demand outstrips supply in the economy. Government spending has focused mostly on consumption (or current) expenditure and has been directed mainly to imported goods with additional consumption spending and greater domestic demand leaking overseas in the form of higher imported goods, however, it is not spending to enhance the productivity (supply side) of the economy. This necessitates spending more to buy imported consumer goods, which are a part of the current account, although the benefit of this is that the exchange rate will be lower if the current account goes into deficit.

This adversely affects the fiscal budget balance and the non-oil part of the current account trade balance. When additional government spending is larger than the higher oil revenues received, the non-oil trade balance deteriorates due to the stronger exchange rate and greater demand for imports. Although this can weaken the currency, it would not deteriorate irrespective of the additional government spending. The stimulus to the demand side of the economy for non-oil output specifically is not matched by increases on the supply side of non-oil output, which can create inflationary pressures (Ndikumana & Abderrahim 2010; Ali & Harvie 2013). Hence, Libya is expected to suffer from the low economic growth and high inflation associated with a higher oil price shock (Yahia & Saleh 2008; Fargani 2013; Ahmouda 2014; Etelawi et al. 2017). Based on the above discussion, this study has two key objectives.

1.2 Objectives

This thesis aims to analyse the existence and possible effects of Dutch disease on the Libyan economy in the MENA region and identify evidence-based policy prescriptions to promote non-inflationary and higher economic growth. Central to this research is Cordon's (2012) dual response that the adverse effects from resource windfall effects (production or price effects) arising from an appreciation of the real exchange rate require authorities to lower domestic interest rates through a contractionary fiscal policy. This can be done by increasing the fiscal budget surplus (or reducing the deficit) and offsetting through an expansionary monetary policy. Another major objective of this study is to determine the best macro-economic policy to promote low inflationary economic growth in Libya by analysing the impact of an oil price shock on key macro-economic factors and the response of fiscal and monetary policy under different exchange rate regimes. To achieve these objectives, the study must answer the following questions and empirically test several hypotheses.

1.3 Research Questions and Hypotheses

The research questions move from the general to the more specific in analysing Dutch disease effects, whereby an oil price increase appreciates the real exchange rate, and adversely affects trade balance, real output and prices. The following complementary hypotheses focus on the relative importance of fiscal and monetary policy responses to Dutch disease effects for managed and floating exchange rates.

Question 1: Is the Dutch disease theory relevant to a small, open, oil-exporting developing country like Libya?

Question 2A: How do fiscal and monetary policies, in conjunction with oil price increases, affect the Libyan macro-economy?

Question 2B: How does the implementation of a managed exchange rate regime affect the Libyan economy compared to that of a floating exchange rate regime for the case of an oil price increase?

Question 3A: Is the composition of fiscal spending important for determining real output and domestic price outcomes with a floating exchange rate and an increase in the oil price?

Question 3B: What is the appropriate macro-economic policy response under a floating exchange rate to improve macro-economic outcomes in term of higher real non-GDP (or growth) and lower domestic prices (or inflation) to reduce the Dutch disease?

Question 3C: Can a Taylor rule for setting the domestic interest rate and nominal exchange rate be more effective in promoting real economic growth in terms of higher real non-oil GDP and lower domestic prices?

To answer these research questions, the study addresses a number of testable hypotheses.

Hypothesis 1: The Dutch disease exists for Libya, whereby an oil price shock appreciates the real exchange rate and worsens real non-oil GDP[5] and domestic prices.

Hypothesis 2A: Increasing the fiscal budget surplus in Libya counters the Dutch disease effects under a managed nominal exchange rate[6] regime.

Hypothesis 2B: Reducing the domestic interest rate with expansionary monetary policy in Libya counters the Dutch disease effects for a managed nominal exchange rate.

Hypothesis 3A: Fiscal investment (capital) spending is more effective than fiscal consumption spending in countering the Dutch disease effects (slower growth, deterioration in the non-oil trade balance and stronger exchange rate) under a floating exchange rate.

Hypothesis 3B: Expansionary monetary policy is more effective than contractionary monetary policy in countering the Dutch disease effects for a floating exchange rate[7].

[5] Since the main interest of this study to investigate how to improve the growth in real non-oil GDP, the current study considers real non-oil GDP even though the traditional Dutch disease research emphasises the impact of oil shocks on the non-oil tradeable sector..

[6] Managed exchange rate is a hybrid of fixed and floating exchange rate regimes. Typically, a country will "peg" its currency to a major currency such as the U.S. dollar, or to a basket of currencies. The choice of the currency (or basket of currencies) is affected by the currencies in which the country's external debt is denominated and the extent to which the country's trade is concentrated with particular trading partners. The system is a method to fully use the key under the fixed exchange regimes as well as the flexibility under the floating exchange rate regime (Jakob 2016).

[7] It will lead to lower interest rates, less capital inflows (more outflows) which will depreciate the currency.

Hypothesis 3C: A Taylor rule for the domestic interest rate and the nominal floating exchange rate is effective in promoting non-inflationary economic growth for the Libya economy, subject to a Dutch disease oil price increase.

1.4 Contribution and Significance

This study will provide a basis for a better macro-economic policy for oil-exporting countries such as Libya (and other MENA countries) to manage the effects of Dutch disease and external shocks, to achieve high and stable economic growth, and low inflation. Further, this study has provided a unique and dynamic macro-economic model as an extension to existing literature for a small, developing, oil-exporting economy, which characterises Dutch disease related to oil price shocks, and macro-economic policies responses of MENA countries, (fiscal, monetary and exchange rate policies in particular) using Libya as an example. The literature review (see Chapter 3) reveals that there is no model in the extant literature that investigates Dutch disease in relation to monetary policy. More recent models, such as those proposed by Ali and Harvie (2017) and Mohammadzadeh (2015) investigated Dutch disease using fiscal policy only. This study emphasises Dutch disease but with responses from both fiscal and monetary policy under different exchange rate regimes. It will make a theoretical contribution by developing a macro-economic model relevant to Libya, incorporating the theoretical models of Cox and Harvie (2010) with the extended theory of Dutch disease by Corden (2012) and Taylor (1993, 2001), highlighting the best monetary policy.

Further, this study uses a unique approach to estimate data through partial equilibrium estimations based on a theoretical model—structural factor autoregressive (SVAR) empirical model—and investigates the research issues, objectives and research questions. It tests the research hypotheses identified previously. SVAR can isolate the response of each variable to structural shocks and policy innovations, and show macro-economic transmissions over time.

The major contribution of this thesis is primarily empirical. The research will use new Libyan economic data to show the relationships between oil price shocks, macro-economic policy responses, real non-oil GDP (or growth) and domestic prices (or inflation). The study will analyse empirical evidence for incorporating fiscal and monetary policy responses from oil price shock with the objective of improving inflation and economic growth outcomes under differing exchange rate regimes in Libya.

The study also aims to empirically test Corden's (2012) suggestions to determine the best exchange rate regarding the response of fiscal and monetary policies to alleviate Dutch disease and offset the adverse effect of external oil prices shocks on the economy. These findings can provide information to policymakers in oil-exporting countries such as MENA on how best to implement macro-economic policy to manage external oil prices shocks to improve the macro-economic consequences for real non-oil GDP (or growth) and domestic prices (or inflation).

1.5 Scope and Structure

1.5.1 Scope

As explained previously, although the focus of this research is the Libyan economy, the scope and outcomes from the study are also relevant for other oil-exporting countries in the MENA region, and for resource-exporting developing countries worldwide. Libya is an oil-exporting developing country that has been adversely affected by oil price shocks and Dutch disease effects in the past. The study historically reviews and empirically analyses the importance of the oil sector in the Libyan economy, and the potential adverse consequences of oil price shocks on real non-oil GDP and domestic prices in particular.

The temporal scope was determined by data availability; 1980–2016 is the longest sample for which reliable data is available. The historical review of the country's development covers 1951–2016. In 1951, Libya obtained its independence under the leadership of King Idris Al-Sanusi after a long war with Italy. Various historical events followed the independence of Libya. The first significant event under the Al-Sanusi regime included the discovery of oil in 1958 (Moussa 2005) and the rebuilding of the country. The second major event occurred in September 1969, when the revolutionary government (led by the Qaddafi regime) implemented policies to transform the economy from a capitalist to socialist one. The third major event was the oil boom from 1973–1979, which resulted in higher oil revenue and increased total public revenue. The fourth event was the volatility of international market oil prices in the 1980s, which led to lower oil GDP. The fifth event occurred when economic sanctions were imposed by the US and United Nations (UN) from the early 1990s, which resulted in the freezing of the country's foreign assets and a decline in economic growth of both oil and non-oil GDP due to constraints on foreign trade. Finally, the recent uprising (February 2011–present) resulted in ongoing civil war (Fargani 2013; Ahmouda 2014).

1.5.2 Structure

Chapter 2 shows that the boom in the oil sector during the 1970s had a positive impact on real GDP in Libya. This situation subsequently changed, especially during 1980–2016, when Libya became a predominantly oil-based country. It lost much of its economic diversification in the sources financing real GDP due to higher oil revenue. Further, the appreciation of the real exchange rate exerted a negative impact on non-oil sectors due to oil-related price and production shocks. The main contribution to the real GDP was now from the oil sector. Thus, external oil price shocks affected the nation significantly (Yahia & Saleh 2008; Fargani 2013; Ahmouda 2014; Alimohamed 2014; Etelawi et al. 2017). This study emphasises the most critical period, 1980–2016, when world oil prices fluctuated sharply. The impact of Dutch disease effects on the Libyan economy increased in significance and strength during this time. This is the most prolonged period for which data is available and will be further investigated in Chapter 2.

Chapter 3 reviews Dutch disease theory in various aspects, while other resource curse components are also considered. Dutch disease theory emphasises that an appreciation of the exchange rate occurs due to oil price and oil production shocks, which then affect the non-oil trade balance and non-oil tradeable sector output due to a loss of competitiveness in international markets. A spending effect happens when higher oil prices and production increase income in a nation, leading to increased demand for both tradeable and non-tradeable goods. This results in increased prices in the domestic economy (Corden 1985). Non-tradeable commodity prices rise relative to tradeable commodity prices (determined in world markets) equivalent to an appreciation of the real exchange rate. The empirical review in Chapter 3 shows that this spending effect on domestic prices is also associated with other factors related to the macro-economic policy environment, such as a focus on spending for consumption more than investment, the way the fiscal budget deficit is financed, and an underdeveloped financial sector. The impact of an appreciation in the exchange rate can be exacerbated by the adoption of a pegged exchange rate regime for a prolonged time at an unrealistically and uncompetitive exchange rate against the US dollar. This has an adverse influence on real non-oil GDP, domestic prices and economic stability (Ali 2011; African Development Bank 2008, 2017). Therefore, one of the key aims is to expose the existence of Dutch disease symptoms in the Libyan economy and investigate how Dutch disease affects real non-oil GDP (growth) and domestic prices (inflation), and the response of macro-economic policies to this.

In Chapter 4, a theoretical macro-economic model is developed to examine the consequences of several macro-economic policies following an oil price shock, based on existing theoretical and empirical contributions. It also addresses identified gaps in the extant literature. The macro-economic model introduced in this study reflects the features of a small, open, developing, oil-exporting economy such as that of Libya.

The study uses the model of Cox and Harvie (2010) to develop a dynamic macro-economic model for Libya and model Dutch disease effects on economic growth, and possible fiscal and monetary policy responses in the short and long term. Cox and Harvie's (2010) model is a dynamic long-run equilibrium model that investigates the consequences of a permanent resource price shock on major macro-economic variables. The model includes a product market, asset market, aggregate supply and foreign sector. It considers several effects of a resource boom on an economy and emphasises a number of effects: a spending (or wealth) effect, an income effect, a revenue effect, a current account effect and an exchange rate effect. This model is explained in detail in Chapter 4. The current study extends and elaborates upon the Cox and Harvie (2010) model by incorporating Taylor (1993, 2001) monetary policy, enabling an analysis of Corden's (2012) proposal of using both fiscal and monetary policy to reduce the adverse effects of Dutch disease. The Cox and Harvie model is also extended/adapted to analyse the impact of resource/oil shocks under different exchange rate regimes. The proposed extensions and amendments of this model is discussed in Chapter 4. This chapter also justifies using SVAR method and distinguishes between the recursive and non-recursive form of the SVAR approach to enable a clear understanding of why this study uses the non-recursive form of the SVAR in empirical analysis later. Further, the chapter explains stationarity and non-stationarity issues and appropriate data forms for SVAR.

In Chapters 5, 6 and 7, macro-economic empirical frameworks from a technical perspective, the advanced estimation structural facto vector autoregressive model (SVAR), and impulse response function (IRF) simulation techniques are applied to the empirical dynamic macro-economic models and conducted through the EViews 8 and 10 programs. Preliminary analysis of the VAR/SVAR starts with the autocorrelation test and lag length selection criteria to verify the suitability of data for VAR/SVAR, IFR and the variance decomposition. The purpose of employing the SVAR model of SVAR is to illustrate the linkage of the theoretical model with the empirical models. SVAR can form the sets of variables related to the underlying economic concepts of real economic activity, prices and macro-economic policies. It utilises these factors to explore the relationships between these economic concepts and macro-economic policy responses. The SVAR method and its generation SVAR is particularly suited to assess the effects of fiscal and monetary policy innovations, since it isolates the response of each variable to structural shocks and policy innovations and shows their macro-economic transmissions over time (Aarle et al. 2003; Bernanke et al. 2005; Liu & Jansen 2013).

Chapter 5 estimates a submodel, the foundations of which are discussed in Chapter 4 using dynamic simultaneous VAR and SVAR models to test for the existence of Dutch disease in the Libyan economy. The dynamic simulations of oil price shocks are used to analyse the impacts on the managed real exchange rate, real non-oil GDP and domestic prices.

The scope of the study broadens in Chapters 6 and 7. Expanded models compare the simultaneous outcomes of different macro-economic fiscal and monetary policies under managed and flexible exchange rate regimes. Chapter 6 tests Corden’s (2012) suggestion of mitigating Dutch disease effects through two frameworks. The first framework examines oil price shocks and a fiscal policy response that emphasises the fiscal budget surplus to depreciate the real exchange rate to improve the real non-oil trade and real non-oil GDP. The second framework examines the use of monetary policy through a lower interest rate arising from oil price shocks.

Chapter 7 analyses several alternative macro-economic policy responses to Dutch disease to identify the best macro-economic policy response indicated by the real non-oil GDP and domestic prices using dynamic simulations based on impulse response function (IRF). These include fiscal and monetary policy responses under different exchange rate regimes that can be implemented by policymakers in oil-exporting MENA countries. These policies are derived from results presented in Chapter 6 and IMF and World Bank recommendations to manage Dutch disease in Libya.

Chapter 8 provides the major conclusions and summarises the key findings in relation to the research questions and hypotheses identified in Section 1.3. Key policy implications will be provided to identify alternative macro-economic policies, including fiscal and monetary policies under different exchange rate regimes, which can mitigate the adverse effects of Dutch disease arising from oil price shocks. The last section identifies the major strengths and limitations of the study, and highlights its significance for other oil-exporting MENA countries. Potential directions for future research are also mentioned. The first step of thesis is to review Libyan economy, which will be done in Chapter 2.

Chapter 2

The Libyan Economy and its Development Characteristics – An Overview

2.1 Introduction

Libya is a small, open, oil-producing and exporting developing economy located in the MENA region. It mainly depends on one sector to support its economy—the oil sector (Yahia & Saleh 2008; Etelawi et al. 2017). Libya is abundant with this non-renewable natural resource, which accounts for 4% of the world's total oil reserves. Libya is seventh on the 2016 list of countries by oil reserves according to the Organization of Petroleum Exporting Countries (OPEC 2017; see Table 2.1 in Appendix).[8] Further, Libya's oil reserve is primarily heavy crude, which is high-grade oil. Therefore, this abundant high-quality oil should command a higher price in the world market.

The Libyan economy has endured significant reforms, shocks and fluctuations since the nation gained independence in 1951. These events affect the development of the Libyan economy, and influence the reliability and quality of the nation's economic data. In the context of this study, it is essential to provide an overview of the Libyan economic, social and political situation to understand trends in the main macro-economic variables included in the model developed in subsequent chapters (see Chapter 4). This overview describes historical developments and details changes to key macro-economic variables of the Libyan economy. Geographic and demographic details are also provided. More contemporary economic events and outcomes in the country will be discussed, followed by a description of historical phases of economic reforms.

A clearer understanding of social and economic events in Libya is needed to inform policymakers, who can use the findings to enhance the future prospects of the economy. The development of a contextual understanding in this chapter provides

[8] The OPEC share of world crude oil reserves represents 81.5% (OPEC 2017).

answers to key economic questions such as 'where' and 'when' major events occurred. It also provides important insight into the macro-economic factors that will be considered. Therefore, a thorough understanding of the Libyan context allows interested researchers to situate their studies or compare similar studies in different contexts. The substantive role of the oil sector in the Libyan economy is first described; the effect of the oil sector on non-oil sectors will then be examined.

Details of the Libyan context and relevant macro-economic variables, issues and policy are presented in the following four sections. Section 2.2 comprises a historical review of the evolution of the Libyan economy from 1950–2016. This section is divided into six periods and subsections, based on significant events that have occurred in the country in 1950–2016. Section 2.2.1 describes Libya as a poor and underdeveloped economy during the pre-oil exporting era period (1950–1960), while Section 2.2.2 presents the period of oil development and fiscal planning during the Libyan oil development/boom (1961–1980). Section 2.2.3 describes an economic deterioration period (1981–1991) characterised by international oil price volatility. Section 2.2.4 reviews the period of limited economic reforms and oil-exporting constraints arising from UN economic sanctions (1992–2002). Section 2.2.5 illustrates the recovery of the economy and oil exports during the post-UN economic sanctions period (2003–2010). Section 2.2.6 clarifies the economic and oil infrastructure deterioration during the civil uprising (2011–2016), while Section 2.3 highlights contemporary issues and challenges facing the Libyan economy. Section 2.4 summarises the major findings of this chapter. The next section elucidates the evolution of the Libyan economy during 1950–2016.

2.2 Evolution of the Libyan Economy during the period 1950-2016

This section explains the main characteristics of the Libyan economy in the six specific periods, and the significant events within each period since the country's independence (1951–present). In each period, main characteristics such as Libya's GDP, natural resource endowments, oil sector and the contribution of the non-oil sector are discussed. Also, every period presents a detailed analysis of trends in key macro-economic indicators—the fiscal budget, inflation, money supply, interest rate, nominal and real exchange rate, and external sector developments including exports, the current account and foreign direct investment. Section 2.2.1 will illuminate the characteristics of the Libyan economy during the pre-oil exporting era (1950–1960).

2.2.1 Characteristics of Libya's pauper economy, the pre-oil era exporting period (1950-1960)

In the early 1950s before the discovery of oil in Libya, the economy had the same characteristics as most other developing countries in the MENA region, with an abundance of labour and scarcity of capital (Hassia & Megarbi 1984). This was exemplified by a low per capita income and living standards that were locked at the subsistence level. This was exacerbated by a low standard of education and the spread of disease such as tuberculosis (the 'white plague'), measles and childbirth deaths. Industry was non-existent, except for some light industries of insignificant value; mineral resources were not yet discovered. These factors led to considerable poverty (Ahmouda 2014).

As agriculture represented the primary sector of the economy in the 1950s, a significant ratio of the working population was based in rural areas with low productivity and high poverty (Lipst 1959; World Bank 2006). The country was mainly dependent on the agricultural sector and the export of agriculture products (World Bank 1960; Bhairi 1981), such as groundnuts, almonds, olives and potatoes, all of which suffered price fluctuations based on weather conditions and seasonal patterns. Libya's agricultural reliance was a burden, particularly because the nation was underdeveloped and suffering from a lack of technology in all agricultural production processes such as ploughing and harvesting (Ahmouda 2014). Thus, low agricultural productivity was a major issue in the 1950s. This led to lower agricultural production, lower agricultural exports and higher imports of consumption goods (Ahmouda 2014).

A lack of capital investment due to the absence of agricultural credit banks[9] also had a severe effect on the traditional agricultural sector (Ahmouda 2014). Their absence

[9] Credit bank that provide loans to agriculturalists to improve productivity (World Bank 1960).

negatively affected domestic agricultural production. This was particularly burdensome for the important agriculture sector. An underdeveloped agricultural sector ensured that the Libyan trade balance suffered from high deficits during the 1950s, which ultimately affected domestic government revenue (World Bank 1960; Bhairi 1981; Ahmouda 2014).

As shown in Table 2.1, the trade balance was negative in all years from 1950–1960. This was as a direct result of decreased total exports and increased total imports, which were mostly produced to feed the population (World Bank 1960; Bhairi 1981). The country was mostly reliant on aid from foreign countries such as the US and the United Kingdom (UK) to finance the fiscal budget deficit. The fiscal budget deficit increased from LYD3.6 million in 1953 to LYD16.8 million in 1960. This was a result of expenditure by foreign oil exploration companies hosted by Libya in the late 1950s. The government offered financial incentives for these companies to come to Libya and explore for oil; this was funded by the public budget (Baryun 1980; Bhairi 1981; Ahmouda 2014). Expenditure by these companies exceeded LYD$13.5 million from 1953–1960, of which LYD0.54 million (around 4% of this) was paid in wages and compensation to Libyans who were directly engaged in these firms (Abohobiel 1983). Most remaining expenditure was represented by purchases of supplies through local contractors (Abohobiel 1983). In other words, the pre-oil exporting era of the Libyan economy was characterised by poverty, dependence on foreign aid and economic turmoil. In the 1950s, researchers had doubts about the development potential of the Libyan economy and described it as a 'deficiency economy' (Hassia & Megarbi 1984).

The monarchy that took power in Libya and presided over economic affairs from 1951–1969 faced challenges transitioning from a poor to a developing nation (Fayad 2000). Construction, education, health, infrastructure and government institutions were poorly organised and only remnants of these institutions were left after the war with Italy and liberation from the Italian colony during 1947–1951 (El Azzabi 1974; Vandewalle 1996). There was no especial Libyan currency in the domestic economy and citizens used foreign currencies, since the existence of a monetary sector was very poor (Fayad 2000). This imposed an enormous burden on the government (Fayad 2000) given that it bore the joint responsibilities of fulfilling every societal requirement and finding the best way to achieve these objectives (Ghanem 1987).

Table 2.1

Libyan Macro-Economic Indicators (in Million LYD) During the Pre-Oil Exporting Era (1950–1960)

Year	Total exports	Total imports	Trade balances	Population (millions persons)	Total foreign aid	Consumer price index	Government expenditure	Domestic government revenue	Fiscal budget
1950	10.58	19.55	–8.97	NA*	NA	NA	NA	NA	NA
1951	13.22	33.71	–20.50	NA	NA	NA	NA	NA	NA
1952	12.46	32.59	–20.13	NA	NA	NA	NA	NA	NA
1953	9.74	31.81	–24.86	1.11	10.7	109	8.8	5.1	–3.69
1954	10.75	31.35	–24.86	1.13	14.6	104	12.9	6.6	–6.38
1955	12.86	40.26	–27.40	1.17	20.9	100	15.4	7.8	–7.60
1956	11.63	46.48	–34.85	1.21	17.3	109	17.0	9.1	–7.89
1957	15.16	78.61	–63.45	1.26	16.3	114	20.0	9.8	-10.18
1958	14.21	96.60	–82.39	1.30	21.9	128	20.6	11.1	–9.50
1959	12.04	113.64	–101.60	1.35	19.9	127	28.3	14.9	-13.33
1960	11.29	169.08	–157.79	1.14	19.9	128	34.5	18.0	–16.48

Source: Central Bank of Libya (1976), Abohobiel (1983).
* NA: not available.
** The nominal official exchange rate was LYD$0.28 per US$1 during 1950–1960 (World Bank 1960).

The first achievement of the monarchy was the establishment of the Libyan monetary authority, which was established under the name of the Libyan Currency Commission in 1951. This name was changed later to the National Bank of Libya, and in 1963, it became the Central Bank of Libya (CBL) (Otman & Karlberg 2007). Practically speaking, the CBL did not act until 1956 when it started issuing Libyan pounds (Fayad 2000).

The second achievement was the discovery of oil in 1958 and subsequent establishment of new financial resources with which to develop the country and improve the standard of living (Ghanem, 1987). In the 1950s, the country hosted experts to explore for oil (Martinez 2007). The first oil well was discovered by the Standard Oil Company (known as Esso) in 1958. It produced about 500 barrels a day. In one year, oil production rapidly increased to 17,500 barrels a day when foreign oil exploration companies discovered six more oil wells in 1959 (Fattouh & Darbouche 2010). From this period, the oil sector has been the leading sector of the economy, and its revenues have been used to achieve government policy objectives and economic growth (Ghanem 1987). The next sections review the development of oil production and key macro-economic indicators in Libya over more than four decades.

2.2.2 Development, oil boom period and fiscal plans during the period of Libyan oil development (1961-1980)

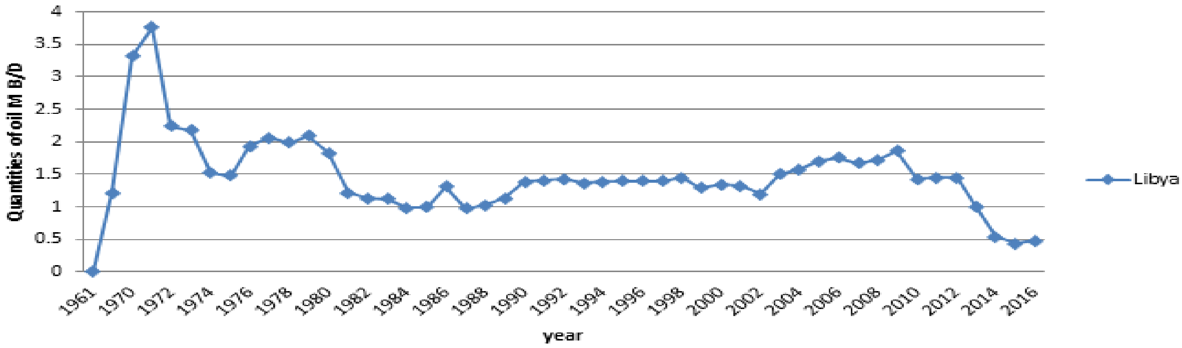
The discovery of oil and particularly the commencement of oil exportation in the beginning of the 1960s brought remarkable changes and unexpected wealth to the Libyan economy (Ghanem 1987). Importantly, in the 1960s, Libya became the third-largest oil-producing country among the OPEC. Geological aspects, such as the proximity of onshore oil fields to Europe, the flow of oil towards the sea, and the effortlessness of drilling, helped Libya produce oil more cheaply than many other oil producers (World Bank 1994). The Libyan topographical spot between industrial economies in the West and the developing economies of North Africa, decreased costs of transportation and expanded the essentialness of Libyan oil in the international oil market (World Bank 1994). High-quality Libyan oil commanded a higher price. These factors made Libya an attractive prospect for oil-related foreign capital investments and technology (Fattouh & Darbouche 2010). During the 1960s, increased investment and advanced extraction technology increased oil production, and rapidly increased government revenue (World Bank 2006). The monarchy made concessionary agreements with foreign oil companies to attract foreign investment in the oil sector. For example, oil companies were originally entitled to a fixed tax-free share of oil production, ranging from 15% for onshore and 19% for seaward squares (Fattouh & Darbouche 2010).

To increase the production of oil and oil revenue, the government gave foreign oil companies long-term research, development, extraction and export rights for expansive territories with no restrictions in return for royalties and taxes (see Gurney 1996; Mahmud & Russell 1999). As a result, oil production increased significantly and reached 1.5 million barrels a day on average in 1961–1965. Real GDP increased, the standard of living improved and the Libyan economy changed from a primarily agricultural economy to an oil-producing economy (Bhairi 1981). The Libyan economy was transformed from an aid-dependent economy to a capital-abundant economy, and job opportunities expanded in both the oil and non-oil sectors (Khader 1987). By the mid-1960s, the structure of the Libyan economy had changed from agricultural to oil-producing/exporting when oil production increased sharply to reach 1.7 million barrels per day, and the annual average oil revenue increased to LYD$1.388 billion (Bhairi 1981; Edwik 2007). The improvement of the industrial sector was accelerated by the foundation of the Agricultural and Industrial Bank, which prompted the expansion of credit services and assisted government investment by establishing plants in 1961–1980 (Badi 1983). During the 1960s, the Libyan dinar was valued at LYD$0.36 per US$1 (Masoud 2013), and appreciated due to oil shocks, which adversely affected non-oil sectors over time. This will be discussed later in this chapter.

The Libyan government aimed to achieve economic growth and development, and attempted to gain an advantage from oil revenue to develop both oil and non-oil sectors. From the early 1960s, the Libyan government sought to develop oil sectors (as shown above) and accelerate economic diversification through the development of other sectors (Edwik 2007). The monarchy preferred to implement economic planning strategies using oil revenue to improve other sectors to promote economic growth in the underdeveloped country (Moussa 2005; Ruhaet 2013). Every state applies a different strategy depending on its individual circumstances to improve economic growth (Alimohamed 2014). To yield optimum results, each strategy must be tailored to align with the respective country's competitive advantages and circumstances (Moussa 2005).

Therefore, the focus was on fiscal policy, especially government spending via economic plans. Monetary policy did not yet play a significant role in the economy and its development due to the underdeveloped financial sector. The monarchy applied a development plan from 1963–1968 to develop the economy, both oil and non-oil sectors. The main objectives of this plan were to raise real GDP growth and achieve a surplus in the fiscal budget instead of deficits, which the country experienced during the 1950s.

Figure 2.1. The development of oil production in Libya (1961–2016).



Source: OPEC (2002, 2010, 2012, 2016).

The government attempted to utilise the higher oil revenue to improve the non-oil supply side of the economy by focusing on government investment, and encouraging the private sector to participate in economic development (Ghanem 1987; Ruhaet 2013). Therefore, the plan's priorities were to establish infrastructural projects, aimed at benefiting the private sector (Ghanem 1987; Ruhaet 2013). The total allocated fund for this purpose was LYD$169 million, as the government improved the supply elements, especially public infrastructure (Ghanem 1987; Ruhaet2013). This amounted to 42.8% of Libya's first development budget (Otman & Karberg 2007).

Macro-economic variables began to improve after the first plan was implemented. Over 1965–1968, the annual average real GDP growth rate was 22.6%. Yearly average real gross fixed investment increased by 15.6%, with the share of non-oil fixed investment in GDP reaching 63% during 1955–1969 (Masoud 2013). The fiscal budget obtained a surplus of LYD120.5 million in late 1960 (Ruhaet 2013). Government revenue and money supply increased significantly during 1963–1968. The money supply grew by 50%, recorded at LYD241 million in 1968 (Ghanem 1987; Fayad 2000; Ruhaet 2013). The first plan was reasonably successful in terms of real GDP growth and the fiscal budget surplus. However, there was still much to be achieved in terms of economic diversification by the end of the plan, as GDP growth primarily came from the oil sector, which contributed over 80% of total real GDP (see Table 2.4). The non-oil sectors, including both public and private sectors, only represented approximately 20% of total real GDP, so higher real GDP was mainly accounted for by a higher percentage share of the oil sector in total real GDP.

In 1969, a military coup resulted in a new government under the leadership of Muammar Qaddhafi, who changed the state from a monarchy to a military dictatorship. This led to a radical shift in policies and operation of the economy, including that of oil sector policies. This was particularly important given the significance of this sector as a government revenue source (Ali 2011). Libya switched from a country dominated by Western capitalist countries to an anti-Western state. For instance, agreements on production-sharing with multinational oil exploration companies changed in the 1970s (see Gurney 1996; Mahmud & Russell 1999). Instead of these agreements, the Libyan National Corporation (LNOC) was established to operate the oil sector. It controlled oil production and the share of oil revenue allocated to the government (Fattouh & Darbouche 2010; Mezran et al. 2013). Therefore, massive oil revenues increasingly dominated government revenue, especially in the 1970s due to three major oil shocks (1970, 1973 and 197). This gave the government greater motivation to develop other sectors of the economy using oil revenue to generate jobs (Fargani 2013).

The 1970 oil production boom resulted in an increase of 3.3 million barrels per day. In line with this high production, annual revenue spiked at approximately LYD1.57 billion. There was also a general trend in oil-producing countries for governments to participate in their own oil production through 'semi-nationalisation'.[10] In Libya, the share of the LNOC in oil production increased to 60%. Full nationalisation, however, was not feasible because the government depended on the knowledge and expertise of foreign companies in oil exploitation and production (Fattouh 2008; World Bank 2013).

Oil production was 2.06 million barrels a day, and the world oil price increased to US$25 a barrel at the end of 1979. Due to this high production and price, oil revenue peaked at LYD6.65 billion (OPEC 2005; Edwik 2007). The Libyan government changed its policy towards foreign direct investment (FDI) to explore and produce oil using a semi-

[10] Semi-nationalisation means the Libyan government via LNOC shared oil production with foreign oil companies working in Libya to extracte and produce oil; the higher percentage must be given to Libya.

nationalisation strategy that allowed 40% rather than 15% of oil production to be shared between the Libyan government and foreign oil companies that explored and produced oil in the domestic economy (Gurney 1996; Mahmud & Russell 1999; Fattouh & Darbouche 2010). This attracted investment in the Libyan oil industry from many foreign companies (Edwik 2007; Fattouh & Darbouche 2010; Ahmouda 2014). Consequently, the value of FDI increased by 30% from US$451.27 million in 1977 to US$587.73 million in 1979. This was primarily due to development in the oil sector during the 1970s (IMF 2016). These factors resulted in greater production and exporting of oil.

Tables 2.2 and 2.3 illustrate how increased oil exports, due to significant increases in the price in 1970, contributed substantially to total exports and government revenue. The contribution of oil exports to total exports amounted to 91.9 (Central Bank of Libya 2006). The Libyan trade balance moved into a substantial surplus. Total exports increased by 531.7%, from LYD760 million in 1970 to LYD4.80 billion by 1979. Total imports also grew rapidly, mainly in the form of consumer goods (Ghanem 1987), increasing from LYD372.2 million in 1970 to LYD2.82 billion in 1979 (see Table 2.3). Non-oil imports were financed predominantly by oil revenue (Central Bank of Libya 2000). Further, increased foreign currency reserves due to rising oil prices and oil exports appreciated the exchange rate and adversely affected the real non-oil GDP. As a result, economic growth was negatively affected, with the real GDP growth of the real non-oil sector declining to 4% on an average annual basis during the 1970s (Alimohamed 2014).

Table 2.2

The Production of Oil Sector and Related Indicators during the period 1975-2016

Years	Libyan oil production, million barrels per day (B/D)	Oil price, US dollars	Oil exports, million LYD	Oil revenue, million LYD	Oil revenue, % of total public	Non-oil revenue, million LYD	Non-oil revenue, % of total public	Total public revenue (TPR), million LYD
1975	1.4798	12.21	1925.3	2781.51	74.18	967.96	25.82	3749.47
1976	1.9326	13.10	2711.2	4222.24	77.24	1244.19	22.76	5466.43
1977	2.0634	14.40	3189.7	5169.00	77.78	1476.30	22.22	6645.30
1978	1.9825	14.95	2719.5	4119.77	72.61	1554.23	27.39	5674.00
1979	2.0917	25.10	4619.2	6646.53	78.28	1844.73	21.73	8491.26
1980	1.8316	35.52	6486.4	7145.72	83.09	1454.11	16.91	8599.83
1981	1.2178	15.00	4226.3	5652.89	78.79	1521.16	21.20	7174.05
1982	1.1360	35.52	3875.5	3970.81	72.63	1496.60	27.37	5467.41
1983	1.1211	34.00	3573.1	3894.04	73.12	1432.25	26.89	5326.29
1984	0.9846	32.38	3248.4	3340.82	70.55	1394.80	29.45	4735.62
1985	0.9977	25.00	3592.2	4555.44	77.92	1290.79	22.08	5846.23
1986	1.3080	14.17	2398.3	3362.67	74.54	1148.69	25.46	4511.36
1987	0.9725	18.20	1297.5	2700.00	65.66	1412.08	34.34	4112.08
1988	1.0227	14.17	1615.5	1974.36	53.48	1717.45	46.52	3691.81
1989	1.1292	17.91	2200.6	2851.22	62.26	1728.63	37.74	4579.85
1990	1.3891	22.99	3014.7	3945.84	73.44	1427.35	26.56	5373.19
1991	1.4059	19.37	2909.2	3789.55	78.10	1062.95	21.91	4852.50
1992	1.4327	19.04	2810.9	2945.80	65.29	1565.39	34.70	4511.19
1993	1.3610	16.79	2276.9	3362.67	64.93	1816.38	35.07	5179.05
1994	1.3898	15.95	2694.6	3700.00	74.53	1264.41	25.47	4964.41
1995	1.3990	17.20	2965.9	3074.36	74.05	1077.64	25.95	4152.00
1996	1.3940	20.37	3433.2	3851.22	68.23	1792.88	31.77	5644.10
1997	1.3958	19.27	3275.2	3945.84	67.19	1926.40	32.81	5872.24
1998	1.4490	13.07	2198.7	2789.55	59.78	1876.90	40.22	4666.45
1999	1.2872	17.98	3374.0	3993.22	73.73	1422.56	26.27	5415.78
2000	1.3472	28.23	4992.2	5214.72	72.99	1928.78	27.00	7143.50
2001	1.3235	24.33	5142.2	5243.89	72.61	1978.36	27.39	7222.25
2002	1.2009	24.95	9824.1	9638.68	89.11	1178.28	10.89	10816.96
2003	2.0100	28.89	14047	3455.00	62.27	2093.28	37.73	5548.28
2004	1.5807	37.76	20085.6	8188.00	86.44	1284.78	13.56	9472.78
2005	1.7010	53.35	29969.3	11025.00	92.65	874.92	7.35	11899.92
2006	1.7510	64.27	34891.2	4018.00	79.36	1044.79	20.64	5062.79
2007	1.6730	71.13	53397.7	5863.83	81.61	1321.41	18.39	7185.24
2008	1.7210	97.04	62571.0	6441.70	88.56	8324.20	11.44	72741.20
2009	1.8660	61.78	40821.0	55347.00	89.58	6438.00	10.42	61785.00
2010	1.4260	79.03	61012.0	65713.00	91.90	5790.00	8.09	71503.00
2011	0.6090	104.01	22789.0	15830.10	94.15	983.20	5.85	16813.30
2012	1.5020	105.01	75355.0	56932.30	94.68	3199.00	5.32	60131.30
2013	1.0080	102.96	56445.0	47775.70	94.12	2987.00	5.88	50762.70
2014	0.5362	99.60	22951.4	29976.60	95.03	1566.70	4.97	31543.30
2015	0.4340	52.53	13853.2	15597.70	71.40	6247.70	28.59	21845.40
2016	0.4820	44.26	10353.0	10665.50	84.68	1929.70	15.32	12595.20

Source: IMF (2012); OPEC (2010, 2012, 2016); World Bank (1960, 2014, 2016); Central Bank of Libya (2000, 2016)

Two development plans addressing the slow growth of the non-oil sector were implemented during the 1970s. The Libyan government attempted to directly influence non-oil sectors such as services, manufacturing and agriculture through fiscal policy tools. Massive revenues from the development of the oil sector along with higher world oil prices provided opportunities for the government to invest in developing non-oil sectors (Alimohamed 2014).

However, such expenditure was not sufficient to develop the non-oil sector since it lacked the development of the private sector, such as encouraging business start-ups and entrepreneurship, attracting non-oil FDI and improving technology (Al-Fergana 2010; El-Hamoudi 2017; Eldeeb 2015).

Investment and trade were essentially state-driven and controlled by the public sector (Najib 2009). From the 1970s, Qaddhafi pursued socialism for Libya, and the state-planned economy was influenced by the Soviet Union (Najib 2009; Edweib et al. 2013). A series of economic plans were developed to develop the economic base of the economy by channelling these funds into the non-oil sector. This period witnessed two plans: the 1973–1975 plan and the 1976–1980 plan, which built on the 1973–1975 plan and was based on the priorities of the new Qaddafi regime. There was no specific plan during the post-coup period (1969–1972). Policy and the political system were realigned and significantly changed, so the second plan for development only started in 1973 (Alimohamed 2014).

The main aim of these plans was to diversify income sources instead of relying solely on oil to improve the role of the non-oil sector (Al- Jabiri 2012). However, this aim was negatively affected by the oil price shock that reduced the oil revenue to finance these plans. From 1973–1975, the country implemented a short plan to provide for economic change under a new political system and primary government control over oil revenues to achieve domestic food self-sufficiency and economic diversification. Economic development goals relied on revenue from oil specifically to augment the output of non-oil sectors after the oil boom in 1970 and 1973 (Alimohamed 2014).

Table 2.3

Exports, Imports, Trade Balance and Current Account Balance Of Libya in Million LYD

Years	Oil exports	Oil exports % (TEX)	Non-oil exports	Non-oil exports % (TEX)	Total exports (TEX)	Total imports	Trade balance	Services	Current balance
1975	1925.3	0.93	127.9	0.0622	2053.2	1665.7	387.5	−264.5	123.0
1976	2711.2	0.94	170.2	0.0590	2881.4	1671.4	1210.0	−434.1	775.9
1977	3189.7	0.92	241.1	0.0702	3430.8	1948.6	1482.2	−571.0	911.2
1978	2719.5	0.91	258.6	0.0868	2978.1	2199.5	778.6	−535.2	243.4
1979	4619.2	0.96	182.2	0.0379	4801.4	2821.7	1979.7	−767.4	1212.3
1980	6486.4	0.99	51.5	0.0078	6537.9	3752.1	2785.8	−306.3	2479.5
1981	4226.3	0.95	183.2	0.0415	4409.5	5127.7	-718.2	−515.3	−1234.0
1982	3875.5	0.94	229.0	0.0557	4104.5	3920.1	184.4	−598.2	−413.8
1983	3573.1	0.96	130.2	0.0351	3703.3	3343.1	360.2	−757.7	−397.5
1984	3248.4	0.96	102.4	0.0305	3350.8	3386.0	-35.2	−331.3	−366.5
1985	3592.2	0.97	81.0	0.0220	3673.2	2487.9	1185.3	−266.0	919.3
1986	2398.3	0.97	60.7	0.0246	2459.0	1895.7	563.3	−136.5	426.8
1987	1297.5	0.76	399.8	0.2355	1697.3	2009.2	-311.9	559.8	247.
1988	1615.5	0.97	36.7	0.0222	1652.2	2114.3	-462.1	162.1	−300.0
1989	2200.6	0.99	12.3	0.0055	2212.9	2393.7	-180.8	81.8	−99.0
1990	3014.7	0.92	232.8	0.0716	3247.5	2547.3	700.2	243.5	943.7
1991	2909.2	0.95	129.2	0.0425	3038.4	2763.0	275.4	−343.8	−68.4
1992	2810.9	0.96	107.6	0.0368	2918.5	2430.0	488.5	130.8	619.3
1993	2276.9	0.86	358.9	0.1361	2635.8	2944.0	-308.2	−93.6	−401.8
1994	2694.6	0.93	200.0	0.0690	2894.6	2603.1	291.5	−46.7	244.8
1995	2965.9	0.95	150.1	0.0481	3116.1	2394.1	722.0	83.3	805.3
1996	3433.2	0.98	57.0	0.0163	3490.2	2909.5	580.7	355.8	936.5
1997	3275.2	0.86	515.0	0.1358	3790.2	3090.8	1729.5	−1325.8	403.7
1998	2198.7	0.89	269.3	0.1091	2468.0	2060.7	407.3	−539.9	−132.6
1999	3374.0	0.96	201.0	0.0562	3575.0	2432.9	1142.1	−43.3	1098.8
2000	4992.2	0.81	1193.8	0.1929	6186.0	2690.3	3495.7	−842.7	2653.0
2001	5142.2	0.92	420.8	0.0756	5563.0	5057.6	505.4	418.2	9236.0
2002	9824.1	0.68	4609.9	0.3193	14434.0	11363.0	3071.0	−923.7	2147.3
2003	14047.0	0.76	4385.0	0.2379	18432.0	11260.0	7172.0	−153.3	70187.0
2004	20085.6	0.80	4811.4	0.1932	24897.0	13885.0	11012.0	−337.9	10674.0
2005	29969.3	0.75	9985.7	0.2499	39955.0	17715.0	22240.0	−1422.9	20817.0
2006	34891.2	0.67	16681.0	0.3234	51572.0	20715.2	30857.0	−4937.8	25919.2
2007	53397.7	0.86	8328.3	0.1349	61726.0	21698.0	40028.0	3516.9	43544.9
2008	62571.0	0.81	14456.0	0.1876	77027.0	25938.0	51089.0	−5104,0	45985.0
2009	40821.0	0.88	5479.0	0.1183	46300.0	27000.0	19300.0	−7572.0	11728.0
2010	61012.0	0.98	988.0	0.0159	62000.0	30900.0	31100.0	−9930.7	21169.3
2011	22789.0	0.98	465.0	0.0199	23254.0	24000.0	−746.0	−6072.0	−5326.0
2012	75355.0	0.97	1538.0	0.0200	76893.0	32200.0	44693.0	36070.0	−8623.0
2013	56445.0	0.96	1997.8	0.0341	58442.8	4325.0	54117.0	43587.0	−10530.0
2014	22951.4	0.93	1559.6	0.0636	24511.0	38631.0	−14120.0	-23488.0	−9368.0
2015	13853.2	0.92	1143.7	0.0762	14996.9	22685.0	−7688.1	-13453.0	−5765.0
2016	10353	0.85	1742.0	0.1440	12095.0	24650.0	−12555.0	-17988.0	−5433.0

Source: IMF (2016); Central Bank (1980, 1990, 2000, 2010, 2016).

The government allocated around LYD4.76 billion to its development expenditure to improve the non-oil sector, raise output and achieve domestic food self-sufficiency (Central Bank of Libya 2003; Edwik 2007). This was mainly to to meet high demand for consumption goods from a higher GDP per capita (Ruhaet 2013). These actions influenced the demand side of the economy rather than the supply side, which adversely affected real non-oil GDP growth. It could be argued that increased domestic aggregate demand was a direct result of increased government current expenditure, which was approximately LYD2.67 billion. This expenditure was mainly to increase wages for those in the public sector who could spend on consumption goods. Most of these consumption goods were imported due to limited domestic non-oil production (Central Bank of Libya 2003; Edwick 2007; Alimohamed 2014).

Therefore, the government sought to extend the aim of its plan to improve the economy and lifestyle of citizens via another plan from 1976–1980. This new plan prioritised both economic and social development. Human capital improvement could be achieved by increased education spending. Improvements in technical and vocational education increase labour productivity and the supply side of the economy, thereby improving living standards while simultaneously achieving a more equitable distribution of income and more inclusive growth (World Bank 2009; Alimohamed 2014).

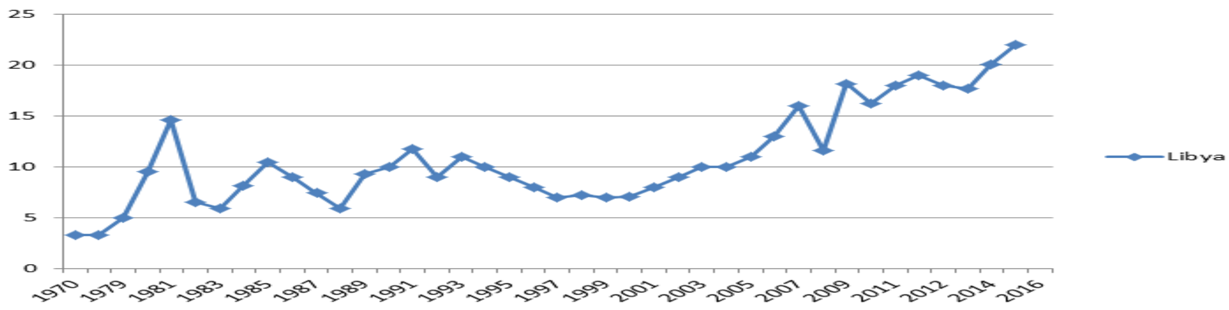
Another aim was to diversify the unbalanced economic structure by augmenting the contribution of commodity production and the service sectors, principally through expanding the agricultural and industrial sectors (Edwik2007; Fargani 2013; Alimohamed 2014). Thus, the plan addressed the requirements for social change (Edwik 2007). It also focused on basic food industries to achieve food self-sufficiency (Edwick 2007; Alimohamed 2014). Investment in development programs commenced and government expenditure rose significantly. The financial allocation for these programs during this period amounted to about LYD1.53 billion, on average 42% of total government expenditure (Masoud 2013). These allocations were funded primarily by oil revenues, which flowed in during a period characterised by government budget surpluses and further enhanced by the third oil boom in 1979 (Alimohamed 2014; see Table 2.4).

However, the growth in tradeable output by the non-oil sector was not significant in the 1970s (see Table 2.4). The annual average share of the manufacturing (3%) and agricultural sectors (4.8%) in total real GDP remained very low during the 1970s (World Bank 2006). However, real GDP growth remained relatively high at 11% in this period (Alimohamed 2014). In contrast, the non-tradeable sector—including retail trade, storage, communication and administration—increased dramatically. Its share of real GDP was 44.1% on average during the 1970s. Development in non-tradeable sectors indicated the existence of Dutch disease effects. The tradeable sector did not improve to enhance total output and economic growth. The services sector contributed 22.7%, and construction[11] increased to 13.9% of real GDP during this period (World Bank 2006). In turn, the economy suffered from the effects of the Dutch disease and intended economic growth in terms of the non-oil sector and the planned increased production of consumer goods did not eventuate (Alimohamed 2014; Fargani 2013). A positive outcome from the development of the non-tradeable sector was the increased engagement of Libyan women in the workforce, a remarkable social transformation. According to the Arab Human Development Report (2009), a significant percentage of Libyan women engaged in the labour force, approximately 60% of female workers were employed in service activities, mainly in education and health (Fargani 2013).

It could be argued that this growth was not employment-generating; the government generated jobs to expand employment in the public sector, at the expense of jobs in the private sector, which continued to shrink. This was not good policy for the attainment of efficient resource allocation, improved productivity and accelerated economic growth. Also, expansion in public sector employment increased government spending for consumption, which encouraged demand for tradeable and non-tradeable commodities and increased their prices (Ndikumana & Abderrahim 2010; Ali & Harvie 2013). Hence, there was a significant spending effect from the Dutch disease in this period, resulting in price increases (see Figure 2.2).

[11] This included, housing, schools and roads.

Figure 2.2. Inflation rate in Libya, 1970–2016.



Source: World Bank (2014); IMF (2006, 2008, 2012); Central Bank of Libya (2014, 2016).

Inefficient operations, specifically government agencies and government-owned firms, and policies that suffered from a lack of accountability and transparency contributed to higher output growth in the non-tradeable sectors than in the tradeable sectors (Edwik 2007). Imports grew by 18% from 1973 to 1980, but they were mainly consumption goods and not investment goods (physical capital with embedded technology from the West) (Fargani 2013). Increased spending on imports was a major outlay that had little sustainable effect. This expenditure adversely influenced the trade account, which stifled the economic growth and contributed to Dutch disease effects. Imports can reduce the size of trade surpluses or increase the deficit and depreciate the currency, but there was no sustainable impact on the economy on the supply side arising from investment or technology-related goods. Hence, the adverse impact on the non-oil trade was transferred to a reduction in the surplus in the total trade balance at the end of this period (see Table 2.3). The exchange rate[12] policy aimed to maintain strong currency value as a strategy to lower inflation rate during the 1970s (Otman & Karlberg 2007).

The Libyan economy also suffered from an inadequately implemented macro-economic policy. It could have been leveraged to control the possible negative impacts of the positive oil price shocks and oil boom on Libyan economic growth in the non-oil sector (Alimohamed 2014; IMF 2008; African Development Bank 2017). Due to weak oil revenue management and ineffective government spending in 1961–1980, the country was characterised by oil dependency and a lack of economic diversification. Hence, the total real GDP and its growth was heavily influenced by oil prices and oil export earnings

[12] About LYD$0.296 could be exchanged for US$1.

(Yahia & Saleh 2008; Fargani 2013). The Libyan economy experienced substantial volatility attributable to world oil price movement during the 1980s, which will be discussed in Section 2.2.3.

2.2.3 Volatility of world oil prices and economic deterioration (1981–1989)

This period was distinguished by sharp fluctuations in world oil prices, which directly affected key macro-economic variables, such as oil revenue, government spending and the budget (see Tables 2.2 and 2.4). This indirectly affected inflation and real GDP growth. The impact was most noticeable in the first half of the 1980s. Inflation increased to 15%, and GDP growth declined to–12%, on average, during the 1980s (World Bank 2016; see Figures 2.2 and 2.3). This negative real GDP growth was closely associated with a decline in the real GDP growth of the oil sector (see Tables 2.2 and 2.4).

In early 1981, global demand for oil declined, due to the combined effects of a worldwide recession, fuel switching and energy conservation. Table 2.2 shows that the world price of oil declined sharply from US$35.5 to US$15 a barrel from 1980–1981, leading to a reduction in the country's oil revenues from LYD7.15 billion in 1980 to LYD5.65 billion in 1981 (Fargani 2013). Further, real GDP growth decreased by 14% in 1981 (see Figure 2.3), and the fiscal budget went into deficit by LYD2.79 billion (Fargani 2013). Due to this adverse shock and its impact on real GDP growth, there was a pressing need to accelerate diversification of the economic base to reduce dependence on the oil sector and boost development of the non-oil sector (Edwik 2007; Yahia & Saleh 2008; General Planning Council 2003).

Table 2.4

The Real GDP, of Oil and Non-Oil Sectors in Libya (1962–2016): Million LYD

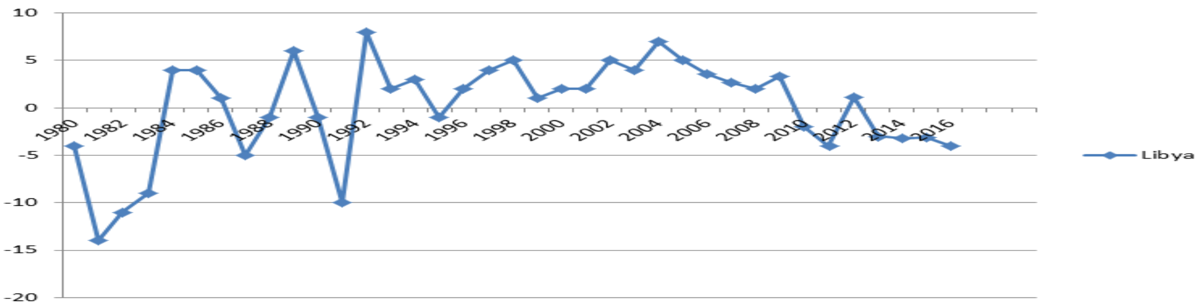
Years	Real oil GDP	Oil % TRGDP	Real GDP of agriculture	Agri. % TRGDP	Real GDP of service	Serv. % TRGDP	Real GDP of construction	Cons.% TRGDP	Real GDP of manufacturing	Manuf. % TRGDP	Total RGDP (TRGDP)
1962	4847.736	76.0	529.4238	8.30	320.8436	5.03	293.4156	4.6	363.5802	5.70	6378.60
1965	13507.53	92.0	880.9260	6.00	4492.723	30.6	528.5556	3.6	1233.296	8.40	14682.10
1970	27776.83	81.5	1158.788	3.40	797.5188	2.34	1158.788	3.4	3135.544	9.20	34082.00
1975	53152.64	84.8	2438.252	3.89	2538.540	4.05	3259.360	5.2	1278.672	2.04	62680.00
1980	51559.78	74.7	6481.209	9.39	4693.527	6.80	3934.280	5.7	2208.719	3.20	69022.46
1981	37763.60	60.1	9883.884	15.73	6748.437	10.74	5780.784	9.2	2576.219	4.10	62834.61
1982	23809.03	39.6	20201.60	33.60	7214.857	12.00	5892.133	9.8	2825.819	4.70	60123.81
1983	31880.30	52.0	11280.72	18.40	9073.622	14.80	6376.059	10.4	2648.517	4.32	61308.26
1984	36796.73	59.0	9978.774	16.00	7733.550	12.40	5613.061	9.0	1933.388	3.10	62367.34
1985	44473.86	73.0	1029.600	1.69	8602.342	14.12	5154.094	8.5	1523.078	2.50	60923.10
1986	39206.89	65.8	1430.039	2.40	10486.95	17.60	6911.853	11.6	1424.080	2.39	59584.94
1987	36998.37	63.7	1742.466	3.00	12023.02	20.70	7666.852	13.2	1103.562	1.90	58082.21
1988	31459.79	64.8	1262.276	2.60	9078.674	18.70	5922.985	12.2	708.8163	1.46	48549.06
1989	28861.45	69.0	949.4999	2.27	6859.823	16.40	4475.616	10.7	627.4229	1.50	41828.19
1990	28945.59	72.4	799.6018	2.00	6196.914	15.50	3518.248	8.8	479.7611	1.20	39980.09
1991	14742.37	63.0	491.4122	2.10	3556.888	15.20	2293.257	9.8	2269.856	9.70	23400.58
1992	15750.42	84.4	436.6821	2.34	328.4447	1.76	1903.486	10.2	223.9396	1.20	18661.63
1993	13535.49	84.3	342.0000	2.13	308.2817	1.92	1653.803	10.3	192.6761	1.20	16056.34
1994	8994.604	84.6	237.0918	2.23	177.5531	1.67	1073.824	10.1	136.0886	1.28	10631.92
1995	6651.005	82.7	188.1905	2.34	147.1746	1.83	965.0794	12.0	88.46561	1.10	8042.328
1996	6199.964	81.4	179.7532	2.35	146.2399	1.92	974.9329	12.8	111.2033	1.46	7616.663
1997	6069.920	82.1	179.6578	2.43	144.1698	1.95	894.5923	12.1	96.11323	1.30	7393.325
1998	5770.777	81.9	173.3347	2.46	133.8764	1.90	873.7196	12.4	89.48580	1.27	7046.126
1999	5778.762	83.4	1482.800	21.4	124.0286	1.79	782.9737	11.3	86.61214	1.25	6928.971

2000	4986.077	64.1	174.2404	2.24	1555.718	20.00	925.6523	11.9	129.9025	1.67	7778.591
2001	48172.78	64.6	1178.220	1.58	14168.47	19.00	8724.792	11.7	2035.785	2.73	74570.87
2002	4772.591	62.6	135.7063	1.78	1662.02	21.80	1044.481	13.7	264.5510	3.47	7623.947
2003	6355.404	72.7	139.8713	1.60	1897.005	21.70	111.8971	1.3	231.6619	2.65	8741.959
2004	79712.35	75.4	1173.484	1.11	11946.28	11.30	9831.895	9.3	2981.284	2.82	105719.30
2005	103546.3	82.1	1299.059	1.03	17657.11	14.00	2396.322	1.9	2434.158	1.93	126122.20
2006	116303.2	83.2	1425.833	1.02	18270.23	13.07	1789.280	1.3	2586.069	1.85	139787.50
2007	141984.6	91.3	1617.349	1.04	10263.94	6.60	2114.994	1.4	1710.657	1.10	155514.30
2008	117050.4	62.3	2010.336	1.07	18788.19	10.00	12400.21	6.6	3795.214	2.02	187881.90
2009	126183.8	88.5	1511.354	1.06	12261.93	8.60	1996.128	1.4	2566.451	1.80	142580.60
2010	10752.53	66.7	324.0267	2.01	3659.406	22.70	3224.146	20.0	1031.727	6.40	16120.730
2011	149263.5	78.0	2851.315	1.49	31058.28	16.23	49754.48	26.0	2870.451	1.50	191363.40
2012	168423.6	91.7	1836.681	1.00	12122.09	6.60	2204.017	1.2	1946.882	1.06	183668.10
2013	104356.6	62.7	4044.443	2.43	4493.826	2.70	7156.834	4.3	5658.892	3.40	166438.00
2014	127489.8	74.1	3853.942	2.24	25291.5	14.70	8086.397	4.7	7174.527	4.17	172051.00
2015	130529.9	77.7	3074.256	1.83	19873.47	11.83	9541.954	5.7	4922.170	2.93	167992.10
2016	88663.91	70.3	4414.277	3.50	19006.62	15.07	9118.635	7.2	4843.092	3.84	126122.20

Source: World Bank (2014); IMF(2000, 2012); Central Bank of Libya (2016)

The intention of this diversification was to create sustainable economic growth, independent of oil revenues, which were volatile due to price instability, and an output linked to international market conditions (Alimohamed 2014). Hence, a plan for economic development covering 1981–1986 gave this high priority. It ambitiously aimed to increase real GDP growth rate annually by not less than 15%. Further, it focused on strengthening the tradeable sector, especially the agricultural sector to reduce imports, which represented about 40% of total imports during the 1980s (Edwick 2007).

Figure 2.3. Real GDP growth in Libya, 1980–2016.



Source: World Bank (2016); IMF (2008, 2012).

During 1981–1986, the government allocated LYD212.6 million to develop the non-oil tradeable sector (Central Bank of Libya 1990). Focus was also placed on reducing government imports of goods for consumption. Instead, increased imports of intermediate inputs and technology was emphasised. Thus, an import substitution strategy aimed at improving local consumer goods industries and reducing imports to meet domestic demand was adopted (Chontanawat 2008).

However, oil remained the principal source of exports and total exports continued to follow the same trend as oil exports. During 1980–1985, declines in oil prices and production reduced Libyan exports by about 44% (Shamyia 2007). This influenced oil revenue and public revenue, the fiscal budget and the trade balance deficit (Ruhaet 2013). The real growth of public revenue decreased from 21.7% in 1980 to 12.5% in 1986, although there was a substantial increase in both per capita real income and economic activity during this period (Alimohamed 2014). Against this background, several large investment projects funded by the state, such as the Great Man-Made River and the Misrata steelworks, were launched.

The higher administrative expenditure (consumption expenditure) comprised around 39% of total government spending, on average, during this period. Hence, the deficit in the fiscal budget at this time was a consequence of higher total government expenditure combined with low public revenue, triggered by a decline in the world oil price (see Tables 2.2 and 2.5). Consequently, real GDP per capita improved in conjunction with an increase in fiscal deficits and higher domestic prices (Ruhaet 2013; Ali 2011; Ahmouda 2014; African Development Bank 2017).

In this context, the government focused on enhancing the role of the private sector in the process of economic development in the second half of the1980s. A primary focus was on establishing new industries that used modern technologies and applied more administrative skills, and providing diversification of income for the economy in general. However, rigidity in the bureaucratic regime and a lack of suitable managerial skills were major obstacles. Infrastructure should have been developed, but political decisions were not always conducive to these changes (Borrie & Thornton 2008, cited in Fargani 2013). In addition, the government attempted to improve non-oil exports through modification of the exchange rate policy. In the first half of the 1980s, the value of the LYD was maintained at a high rate (LYD0.297 per US$1 from 1980–1985). This managed exchange rate policy was changed to a more flexible exchange rate system in which the currency was linked to the SDR (crawling peg system) in the second half of the 1980s, to introduce greater exchange rate flexibility. It was believed that a lower value of the currency had the potential to improve the competitiveness of the non-oil sectors; however, the decrease in the value of the LYD also contributed to inflation as the cost of imports increased (Cevik & Teksoz 2014).

In general, occasional adjustments to the exchange rate led to an increase in the cost of imported goods, which accounted for about 75% of the CPI basket, even though the government subsidised basic commodities (Cevik & Teksoz 2014). The higher rate of inflation during the 1980s was also influenced by large fiscal budget deficits recorded during the period from lower prices and oil revenue (Fisher 1990). Conversely, the monetary authority did not change the interest rate, discount rate or reserve assets ratio on deposits with the objective of influencing growth of money supply (Fayad 2000).

Hence, the Libyan economy faced higher inflation and lower GDP growth in 1981–1989 due to inefficient macro-economic policies—fiscal, monetary and exchange rates. This will be discussed in more detail in Chapters 6 and 7.

Based on the developments, economic conditions began to deteriorate in the 1980s with the fall in world oil prices (Edweib et al. 2013), and the economy was viewed as an 'insufficiency economy' (Ruhaet 2013)[13]. Libya remained an oil-based economy. Political instability also cannot be overlooked as a significant contributor to Libya's economic woes (Yahia & Saleh 2008; Ali 2011; Fargani 2013; Li 2013), as will be discussed in Section 2.2.4.

2.2.4 The period of UN economic sanctions (1992-2002)

By the end of the 1980s, there were further political problems between the Libyan government and the international community, arising from the downing of a Pan Am flight in Lockerbie in the UK on 21 December, 1988. As a result, the UN imposed economic sanctions on Libya for a decade (1992–2002) (Moussa 2005; Yahia & Saleh 2008; Ahmouda 2014). This negatively affected the macro-economy, particularly the oil sector and its trade (Ali 2011). The embargo on manufacturing equipment and replacement parts necessary for oil and non-oil industries created a problem for domestic producers. This affected the cost of running factories and ultimately affected output and the employment rate. Both Libyan and non-Libyan employees working in Libya in the 1990s were strongly affected by economic sanctions and fluctuations in oil prices (Yahia & Saleh 2008; Ali 2011). The sharp decline in oil prices in the 1980s and economic sanctions (1990–2002) had an adverse impact on the movement of skilled non-Libyan workers during the 1990s (Yahia & Saleh 2008). This resulted in a massive exodus of skilled (migrant) labour, which was almost impossible to replace in the short term.

Industries related to the oil sector were not exempt from the adverse impact of the UN economic sanctions. Libya has traditionally been reliant on foreign investment and imports to maintain the oil sector (Moussa 2005). Foreign investment in the Libyan oil

[13] There was lower GDP growth in both non-oil and oil sectors due the decline in oil prices. There was also a deficit in the trade balance and fiscal budget.

sector was severely curtailed due to UN sanctions, as the amount of foreign companies that could invest in Libya was capped. For example, US oil companies were prevented from conducting business in Libya (Moussa 2005; El-Hamoudi 2017).

This contributed to a decline in Libyan oil production in the 1990s (Moussa 2005; El-Hamoudi 2017), which led to a reduction in oil production and exports, on top of other constraints in oil exports. Consequently, Libya experienced negative export growth in the 1990s, although a sluggish recovery was experienced by most other resource-rich countries due to increased oil demand during 1990–1996 (Yahia & Saleh 2008; IMF 2016).

Hence, government revenue declined in line with a fall in oil revenue growth, which was –55% in 1992 (LYD2.95 billion) compared with the oil boom year of 1979 (LYD6.65 billion; see Table 2.2). This further diminished by –72% in 1998. Further restricting government expenditure, the trade balance was significantly affected by the UN embargo from 1992–2002 (Moussa 2005; Yahia & Saleh 2008; Ali 2011; Fargani 2013). As a result of UN sanctions, only imports of necessary goods (e.g., consumer goods and medicine) were permitted. Import restrictions were mainly placed on technological equipment such as electronic goods and computers (Moussa 2005). As a result, imports to GDP declined to 16.2%, 19.17% and 16.11% in 1990, 1995 and 2000 respectively (Ahmouda 2014). Reduced imports also arose from restriction policies in the late 1990s—relating to consumer goods—aimed at reducing the negative impact on the trade balance and current account balances due to oil export limits. Therefore, surpluses on the trade balance in some years in the 1990s (see Table 2.3) arose from reduced imports, not because of improvements in non-oil exports (Moussa 2005; Ahmouda 2014).

Table 2.5

Public Spending in Total and by Type and the Fiscal Budget Balance in Libya, 1975–2016, Million LYD and Percent

Years	Administrative expenditure	Administrative % TRGS	Development expenditure	Development % TRGS	Extra budget	Extra budget % TRGS	Total government expenditure (TRGS)	Fiscal budget
1975	1204.2	0.215805	1939.50	0.347578	2436.30	0.436610	5580.04	-1830.57
1976	1146.3	0.209146	2413.01	0.440247	1921.75	0.350618	5481.04	–14.61
1977	1317.5	0.227359	2520.28	0.434915	1957.09	0.337727	5794.88	850.42
1978	1502.8	0.236322	2587.36	0.406866	2269.06	0.356813	6359.25	–685.25
1979	1759.3	0.222993	3372.20	0.427408	2758.30	0.349599	7889.89	601.37
1980	2350.5	0.479498	2551.60	0.520522	NA	NA	4902.00	3697.83
1981	2232.4	0.201872	4748.43	0.429391	4077.69	0.368738	11058.51	-3884.46
1982	2367.9	0.273703	3834.52	0.443226	2448.95	0.283070	8651.38	-3183.97
1983	2419.1	0.348132	3235.03	0.465544	1294.75	0.186324	6948.92	-1622.63
1984	2377.6	0.344205	2651.30	0.383829	1878.61	0.271966	6907.51	-2171.89
1985	1601.7	0.302683	2064.09	0.390049	1626.02	0.307268	5291.87	554.36
1986	1665.2	0.379488	1349.69	0.307568	1373.28	0.312944	4388.26	123.10
1987	1623.8	0.350289	1501.36	0.323862	1510.57	0.325849	4635.80	–523.72
1988	1707.1	0.421300	1282.70	0.316556	1062.22	0.262144	4052.05	–360.24
1989	1942.4	0.49834	948.20	0.243263	1007.19	0.258397	3897.84	682.01
1990	2122.5	0.452888	1566.95	0.334346	997.15	0.212766	4686.61	686.58
1991	2157.3	0.548763	915.59	0.232896	858.37	0.218341	3931.33	921.17
1992	2030.3	0.567786	752.97	0.210564	792.60	0.221647	3575.96	935.23
1993	2166.6	0.610913	810.73	0.228593	569.21	0.160494	3546.61	1632.44
1994	1998.8	0.575771	875.71	0.252247	597.06	0.171982	3471.64	1492.77
1995	2097.3	0.714739	329.81	0.112396	507.25	0.172865	2934.37	1217.63

1996	2936.0	0.654636	805.31	0.179555	743.67	0.165811	4485.04	1159.06
1997	3037.0	0.679403	860.00	0.192389	573.00	0.128185	4470.10	1402.14
1998	3384.6	0.629664	1171.66	0.217967	819.03	0.152367	5375.39	–708.94
1999	3076.5	0.681099	901.71	0.199625	538.77	0.119276	4517.02	898.76
2000	2298.9	0.558090	1384.31	0.336049	436.08	0.105861	4119.37	3024.13
2001	2969.4	0.638608	1270.85	0.273308	409.58	0.088084	4649.88	2572.37
2002	2452.1	0.496089	2155.91	0.436161	334.89	0.067751	4942.92	5874.04
2003	1821.6	0.521098	1288.19	0.36850	385.95	0.110405	3495.77	2052.51
2004	2757.4	0.390017	2756.67	0.389902	1556.01	0.220081	7070.17	2402.61
2005	2656.1	0.388043	3294.74	0.481329	894.16	0.130628	6845.09	5054.83
2006	2685.8	0.423519	3274.70	0.516372	381.40	0.060141	6341.74	-1278.95
2007	3323.0	0.385002	5308.27	0.614998	NA	NA	8631.36	-1446.12
2008	11874.8	0.269175	28903.30	0.655173	3337.40	0.075651	44115.50	28625.70
2009	10252.9	0.287380	18983.90	0.532102	6440.40	0.180519	35677.20	26107.80
2010	15121.3	0.277461	23729.40	0.435411	15648.10	0.287127	54498.80	17004.20
2011	17580.1	0.752363	NA	NA	5786.40	0.247637	23366.50	-6553.20
2012	36733.0	0.680985	5500.00	0.101963	11708.60	0.217063	53941.00	6190.30
2013	42598.5	0.652516	13276.50	0.203367	9408.50	0.144118	65283.50	-14520.80
2014	26892.0	0.613774	4482.40	0.102305	12439.80	0.283922	43814.20	-12270.90
2015	29196.1	0.676166	4411.90	0.102177	9570.90	0.221657	43178.90	-21333.50
2016	21315.8	0.740430	1398.30	0.048572	5723.80	0.198823	28788.40	-26772.40

Source: IMF (2012, 2016); Central Bank of Libya (1980–2016).
* NA: not available.

The budget's instability and decline into deficit were mainly attributable to lower oil revenue and features associated with the limited tools of fiscal policy on the revenue side over 1992–2002 (Alimohamed 2014). Fluctuations in the budget deficit were also associated with attempts to maintain economic stability in through increased government spending[14] and encouragement of the private sector in terms of investment to improve output (Moussa 2005). However, the contribution of the private sector to gross fixed capital formation (capital stock) by economic sectors was not significant during 1992–2002 because of the insufficiency of private savings (Alafi & Bruijn 2010). Several privatised firms suffered from the need to acquire expensive spare parts. This was compounded by difficulty in obtaining them because of strict procedures imposed on the private sector (Alakdar 2005). There were only a few foreign investment projects in Libya during 1992–2002 as a result of economic sanctions and lengthy foreign investment licensing procedures (Otman & Karlberg 2007). As a result, real non-oil GDP from both public and private sectors remained low in the 1990s (see Table 2.4). Economic sanctions imposed after 1992 limited the ability of the State to direct more investment towards economic diversification, so there was no specific fiscal plan in this period. Consequently, the contribution of the tradeable sectors to total real GDP remained low. Government spending on investment decreased to 26% (of total public spending in 2000), down from 52.1% in 1980. Thus, its share of GDP declined to 8.7% in 2000 compared to 28% in 1980 (IMF 2006).

Conversely, administrative (consumption) spending increased compared with development spending during this period. This was a result of a deliberate change in government policy (a change in policy priorities). As a consequence, the aim of increasing the percentage share of the non-oil sector in total real GDP was not achieved (Alimohamed 2014). The contribution of tradeable sectors to total real GDP remained low. Agriculture's share of total real GDP ranged between 11.9% and 6.5% in 1990–2002. Manufacturing's share of total GDP was also low, fluctuating between 3.4% and 7.3% in the same period. The contribution of the non-tradeable sector to the GDP increased substantially. This contribution ranged between 28.7% and 47.9% of GDP for the services sector and between 5.7% and 16.9% for the construction sector in 1990–2002 (Central

[14] The allocation for development was significant, almost LYD17 billion. Oil revenue constituted about 73% of total spending needs (General Planning Council 2003).

Bank of Libya 2005). The decline in development spending as a percentage of real GDP in 1990–2000 was a key reason for lower economic growth during this period. Lower GDP growth was coupled with a higher inflation rate due to high budget deficits and rapid growth in money supply (Central Bank of Libya 2005). Libya had the highest rate of inflation among the MENA countries during the 1990s (see IMF 2012; Cevik & Teksoz 2014; Caceres et al. 2015). The price of imported and domestically produced goods increased, resulting in higher inflation. Other factors that contributed to the rise in domestic prices included a lack of products in the local market during the 1990s (Moussa 2005), as the Libyan economy depended on imports of both intermediate goods and consumer goods to meet domestic demand (Anderson & Aslaksen 2008). These imports were negatively affected by the UN embargo and contributed to lower domestic output since the economy was dependent on imports for production; this led to an increase in domestic prices.

Edweib et al. (2013) claimed that Libya has a consumer economy that uses large returns from exporting oil for consumption purposes without a corresponding real increase in domestic production, resulting in higher inflation. This also results in higher non-oil imports relative to non-oil exports, exacerbating the weakness in the Libyan non-oil trade balance, and lowering real non-oil GDP growth.

Monetary authorities attempted to address higher inflation by increasing the interest rate, which rose to 10% during the late 1990s (Moussa 2005; Ahmouda 2014; Cevik & Teksoz 2014; Caceres et al. 2015). Despite these efforts, inflation was 13%, on average, in 1986–2002 (Central Bank of Libya 2005), strongly influenced by the lower growth of non-oil output. These figures demonstrate Libya's inability to design and maintain an effective development strategy aimed at sustaining economic growth with lower inflation rates.

In 1992–2002, there was no clear exchange rate strategy, with three exchange rates existing concurrently for the Libyan dinar against the US dollar: the official exchange rate pegged during 1992–2002 at LYD0.360 per US$1 (LYD0.465 per US$1); the special exchange rate used for personal import transactions (by government-connected elites but not ordinary Libyans), travel and medicine (LYD0.465 per US$1); and the black market rate (LYD4 per US$1) (IMF 2003; Ali 2011). Due to increased world oil prices, the higher oil exports resulted in increased foreign currency reserves, and appreciated the official exchange rate (IMF 2006; African Development Bank 2008). Appreciation of the nominal and real exchange rate resulted in lower GDP growth, particularly of non-oil tradeable output (IMF 2006; African Development Bank 2008). This was further exacerbated by the absence of foreign and local investment (Backus 2000). FDI declined and remained at US$58.15 million a year, on average, for over a decade (1990–2002) due to the UN embargo (Moussa 2005; Ahmouda 2014; El-Hamoudi 2017). All these contributed to lowering oil GDP, which adversely affected total real GDP growth (IMF 2006). Higher inflation resulted from greater administrative spending, which led to demand outstripping supply, and an ineffective monetary policy made worse by the adoption of a managed exchange rate regime. Hence, oil price volatility, ineffective macro-economic policies and political issues in 1992–2002 stymied economic growth in the non-oil tradeable sector, such as manufacturing and agriculture, while growth in the non-tradeable sector, such as services, increased. Section 2.2.5 will discuss the post-UN economic sanctions period and the recovery of the economy.

2.2.5: Post-UN economic sanctions and economic recovery (2003–2010)

The lifting of UN and US sanctions in 2003 represented a significant event. The Libyan government activated economic reforms after the lifting of international sanctions (Hossain 2010, cited in Edweib 2013). It freed Libya to trade in foreign markets in late 2002, which contributed to improved Libyan exports, particularly oil exports, and real GDP growth (Massoud 2009). Increased oil exports were associated with an increase in world oil price, openness of the national economy and a substantial devaluation of the official nominal exchange rate at the beginning of 2003 (Alafi & Bruijn 2010).

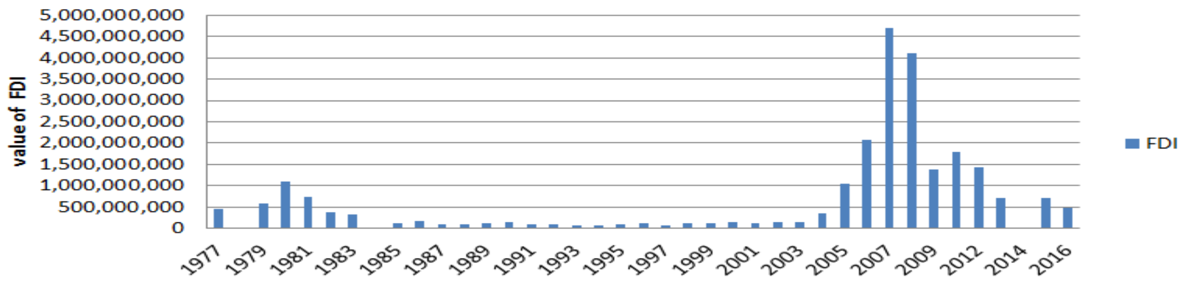
Foreign oil companies returned to Libya after UN economic sanctions were lifted (Moussa 2005). The return of international oil exploration companies, particularly US oil companies, rapidly increased the inflow of foreign investment and oil production (Yahia & Saleh 2008; Etelawi et al. 2017). Oil production rose from 1.2 million barrels per day in 2002 to 2 million barrels per day in 2003 (see Table 2.2).

Oil export revenue increased significantly from LYD9.82 billion in 2002 to LYD20.09 billion in 2004 (see Table 2.3). Improvement in the world oil price had a significant impact on Libyan oil exports and oil revenue. Oil exports peaked at LYD$6.26 billion in 2008 and LYD$6.10 billion in 2010 due to an increase in oil prices to about US$97 and US$104 per barrel in 2008 and 2010 respectively (Central Bank of Libya 2012; see Table 2.2).

In 2003–2010, due to the improvement in the political relationship between Libya and the international community, the government aimed to improve the facilities that encouraged foreign investment (World Bank 2006). For example, two banks were established in 2008 to assist in attracting foreign investors, a key task that involved facilitating or simplifying the process of foreign capital inflow. The state took decisive steps to request World Trade Organization membership with World Bank support (World Bank 2009; African Development Bank 2012). This was followed by investment incentives such as exemption from corporate income tax for up to eight years and exemptions from customs duties and taxes on imports of equipment for the execution and operation of investment projects (IMF 2006). Additionally, economic and structural reforms were implemented to allow Libya to participate in the global economy, including trade liberalisation and reduction in import tariff rates (Hamed 2009; Masoud 2009; El-Hamoudi, 2017). Many foreign investors became interested in investing in Libya; thus, FDI increased considerably, from US$357 million in 2003 to US$4.69 billion in 2007 and US$4.11 billion in 2008 (IMF 2016; see Figure 2.4). Nevertheless, FDI in the oil sector remained dominant to that of FDI in other sectors, representing 60%, on average, of total FDI from 2003–2010 (Hamed 2009; Masoud 2009; Al-Fergani 2010; see Figure 2.4).

This investment contributed to increased oil production in 2003–2010 (see Figure 2.2). The expansion of oil production was most notable in 2006 and 2009, when production increased to approximately 1.7 million and 1.8 million barrels per day respectively. This increased output was associated with higher oil prices, which ranged between US$64 and US$71 per barrel in 2006–2010 (OPEC 2010). This led to higher government revenue from oil exports (LYD6.57 billion in 2010) (OPEC 2012). Income from oil exports doubled and the country achieved large external account surpluses throughout 2006–2010 (IMF 2012; see Tables 2.2 and 2.3). While foreign investment in the Libyan oil sector was higher, industry and agriculture sectors did not receive sufficient investment to enhance their output and increase their exports (Ahmouda 2014). Despite ongoing efforts, domestic and foreign investors in non-oil sectors faced difficulties (Ahmouda 2014) arising from government controls during the Qaddafi regime. There was a lack of good management of oil revenues to improve the rest of the economy, such as enhancing supply, which could contribute to improving non-oil output, its exports and economic growth (Anderson 2008, cited in Ahmouda 2014; Ali & Harvie 2013). This was also associated with Dutch disease in the Libyan economy.

Figure 2.4. FDI, net inflows (in US dollars).



Source: IMF (2000, 2008, 2016).

Real GDP growth remained lower and many other factors contributed to this ongoing weakness of the economy. The most important reasons were the use of oil revenue for consumption purposes without adequate investment in productive capacity, reliance on non-oil imports, weak import-competing sectors, and weak and uncompetitive non-oil export sectors despite economic diversification in the 1970s (Al Jabiri 2012). From the early 2000s, the Libyan government again attempted to use new strategies to develop and diversify the non-oil sector of the economy (Edweib et al. 2013). In 2003, Libya opened its door once more to external trade, particularly with European countries (Masoud 2009). The government focused on the development of non-oil sectors such as manufacturing and agriculture (Masoud 2009; Ahmouda 2014) with the aim of facilitating the country’s greater involvement in the global economy (Masoud 2009) and mitigating the Dutch disease issue. Libyan policymakers believed that the impact of Dutch disease could be mitigated by improving non-oil exports. Further, they held that this would enhance economic growth. With the objective of improving non-oil exports, a number of strategies were implemented.

For example, the government implemented a further change in the exchange rate system to ensure dinar stability, enhance non-oil exports and decrease imports. The exchange rate was to be pegged against the US dollar after periodic devaluations by the central bank (Libyan Organization of Policies & Strategies; Central Bank of Libya 2016) as instructed by the IMF. As a result, the Libyan dinar exchange rate was adjusted 50% lower in 2003 compared to 2001. At the end of 2003, the exchange rate was pegged at LYD1.34 per US$ 1 (IMF 2006; see Table 2.6). This devaluation policy was a serious policy in regard to the application of economic reform programs, since it had a direct impact on exports, economic growth, imports, inflation and economic stability (Libyan Organization of Policies & Strategies 2016). This nominal exchange rate devaluation policy facilitated an increase in non-oil export revenues. (IMF 2008; see Table 2.7). As a result, the percentage share of non-oil exports in total exports increased from 5% in 1999 to 20% in 2008 (IMF 2008).

However, this strategy resulted in higher inflation (imported inflation) due to increases in prices of imported consumer goods, influenced by the large devaluations in the official nominal exchange rate. Libya imported about 75% of its food (World Bank 2009); import payments rose by 40% to about 70% of these imports (equipment, consumer goods, food) over 2003–2010. This indicated that improvement in the output of the non-oil sector was not sufficient to meet domestic demand for consumer products. Hence, the government attempted to improve the output of non-oil sectors. One strategy was to encourage private investment, both domestic and international. It was touted that engagement of the private sector in the process of economic development could achieve economic diversification and reduce Libya's reliance on the oil industry, thereby changing the structure of GDP. Concurrent change in the structure of exports and public revenues, by lessening the role of the public sector while enhancing the industrial role, was considered paramount in the process of economic development (Almhomied 2014).

In 2003–2010, the Libyan government shifted to the privatisation of the public sector, including the oil industry (Ahmouda 2014). Exemplifying these reforms, the government made fundamental changes to its economic and institutional organisations in 2008. A new administrative structure was installed to distribute prosperity directly to the population through the Wealth Distribution Program, aided by the lifting of foreign sanctions in 2003. This program had several objectives. It aimed to minimise corruption, encourage private enterprise, attract more international investors and ensure a better transfer of oil wealth and improvement of the standard of living.

These strategies contributed slightly to an increase in the growth rate of real non-oil sectors, which grew by 6.5% on average in 2003–2013. This renewed growth rate represented a positive step but remained relatively insignificant since it was at a lower percentage compared with other MENA oil exporters (IMF 2013). The intention was to utilise foreign expertise to liberate the Libyan economy. Nevertheless, the strategy did not enjoy substantial government support once it was realised that the stability of the regime was under threat. Thus, it was decided that the structure of the economy should remain almost the same by keeping the oil sector under government control (Masoud 2009; Khan & Mezran 2013). Thus, the structure of the economy remained largely unchanged; as a result, foreign investment remained mostly concentrated in the oil industry. Development of the non-oil private sector was also more complicated than expected under Libya's poor financial system, inadequate infrastructure, inefficient public administration and lack of an educated workforce (IMF 2008; Ahmouda 2014). One main problem faced by private companies was uncertainty created by different and shifting interpretations of the law, in particular, the legislation on taxation and the absence of rapid and transparent mechanisms for resolving commercial disputes (Ahmoda 2014). The Qaddafi regime exercised this control over the economy to deliberately impede the development of the private sector (Khan & Mehran 2013).

Due to weak institutions and governance decision-making, there were many poorly performing industrial projects related to the public sector, with some even reporting financial losses (Alqadhafi 2002). This was also due to some extent to increased competition from private sector imports (IMF 2005). Most industrial projects were delayed and the cancellation of investment and development plans occurred due to rent-seeking behaviour (corruption) (Emhemed 2016). Therefore, Libya remained, and still is, a classic oil-dominated economy from 2000 to 2017. Its economy remains driven by oil production and oil price movements due to the ongoing high degree of oil dependency (IMF 2012; Etelawi et al. 2017). During 2003–2010, there was a surplus in the fiscal budget that was associated with higher oil revenue, despite higher government spending. This was notably achieved in early 2004, 2005, 2009 and 2010 when oil prices peaked (Fattouh & Darbouche 2010; Fargani2013; Etelawi et al. 2017; see Table 2.4). Further, during 2003–2010, Libya experienced an increase in current account surpluses due to a rise in the price of oil and exports, enhancing total export revenue, the trade balance and the current account (Masoud 2009; Fargani 2013; see Table 2.6). Total exports, which recorded an annual growth rate of 13%, on average, during 2003–2010, mostly came from improved oil exports.

Libya's real GDP growth rate was 6.3% in 2004, the highest recorded rate since the 1990s (Alafi & Bruijn 2010). This increased to 7% in 2008 as renewed dynamism continued with reform of oil and other non-oil sectors. Annual GDP growth averaged 5% in 2003–2010. The massive oil revenue continued and allowed the Libyan government to maintain positive fiscal and external balances. The fiscal surplus reached 26% of nominal GDP and the current account surplus reached 34% of nominal GDP in 2008 (World Bank 2009). About 65% of real GDP growth was attributable to the oil sector (African Development Bank 2012; Central Bank of Libya 2016; Salem et al. 2016; see Table 2.4). While the non-oil industrial sector (manufacturing) contributed less than 5%, on average, to real GDP over 2003–2010, the proportional contributions to real GDP by the services, construction and agriculture sectors were 13.8%, 14.7% and 1.1 % respectively (African Development Bank 2012; Salem et al. 2016; see Figure 2.7). Therefore, in 2003–2010, the improved oil sector (production, prices and exports) had a significant impact on other key macro-economic factors including real GDP growth and inflation. Thus, the privatisation reform that aimed to improve the output of the non-oil sector and reduce dependence on oil failed to achieve its target, and instead resulted in higher inflation.

Table 2.6

Inflation Rate, Nominal Money Supply, Nominal Interest Rate and Nominal Official Exchange Rate in Libya, 1975–2016

Years	Inflation rate (%)	Nominal money supply, million LYD	Nominal interest rate (%)	Nominal official exchange rate, LYD per 1US$
1970	3.30	241.0	NA	0.35759
1975	3.30	867.5	NA	0.29679
1979	5.00	2249.4	NA	0.29679
1980	9.50	2898.9	5.00	0.29679
1981	14.60	3512.2	5.00	0.29679
1982	6.50	3232.3	5.00	0.29679
1983	5.90	2884.4	5.00	0.29679
1984	8.11	2711.4	5.00	0.29679
1985	10.48	3492.3	8.00	0.29679
1986	9.00	3041.5	8.00	0.31575
1987	7.44	3438.6	8.00	0.29822
1988	5.90	3011.6	10.00	0.28646
1989	9.30	3682.0	10.00	0.29558
1990	10.00	4645.4	10.00	0.28372
1991	11.80	4442.7	10.00	0.28558
1992	9.00	5168.2	16.00	0.29921
1993	11.00	5384.9	18.41	0.32316
1994	10.00	6057.4	19.00	0.36247
1995	9.00	6372.4	15.70	0.35445
1996	8.00	6718.0	11.50	0.36592
1997	7.00	7021.6	10.70	0.38868
1998	7.20	7187.7	10.00	0.45154
1999	7.00	7891.1	9.5.0	0.46077
2000	7.10	7278.9	8.60	0.54340
2001	8.00	8270.8	8.12	0.64409
2002	9.00	8705.8	8.00	1.21063
2003	10.00	9029.2	8.00	1.30187
2004	10.00	10537.0	8.00	1.24440
2005	11.00	14028.0	8.00	1.34864
2006	13.00	16343.0	8.00	1.28178
2007	16.00	5994.0	9.00	1.22116
2008	11.60	6955.0	10.00	1.24540
2009	18.20	7292.0	8.00	1.23400
2010	16.20	8281.0	8.00	1.25120
2011	18.00	14840.1	8.00	1.25650
2012	19.00	13391.1	8.00	1.25330
2013	18.00	13419.9	6.00	1.25030
2014	17.70	17174.9	6.00	1.33120
2015	20.10	23007.3	6.00	1.38940
2016	22.00	27103.2	6.00	1.43790

Source: World Bank (1960, 2009, 2014); IMF (2006, 2008, 2012); Central Bank of Libya (2014, 2016).
* NA: not available.

In 2003–2010, inflation increased substantially to around 15% on average (see Figure 2.2 and Table 2.6). Higher inflation arose from increased government spending, money supply, domestic demand in the local economy and the pegged exchange rate regime (Cevik & Teksoz 2014). This was coupled with higher food prices, increased public salaries without commensurate increases in labour productivity and large public expenditure programs (Ahmoda 2014). Unemployment rates fell from a peak of 35% in the 1990s to 20% in 2000–2010 (IMF 2013a), when the higher employment plagued the public and services sector, not the productive sectors (IMF 2013a; World Bank 2016).

Monetary disequilibria occurred from rapid increases in money supply, driven by significant changes in government spending (due to the boom in oil) as a share of GDP (Caceres et al. 2015). The increase in oil exports after the lifting of the UN embargo led to a substantial increase in net foreign assets and rapid growth in public spending, including lending to the public (African Development Bank 2017). This resulted increased money supply (by 81%), especially during 2003–2006 (Central Bank of Libya 2010).

Any increase in money supply should be controlled by increasing the interest rate and reserve requirements to help reduce excess liquidity. In this respect, both interest rates and reserve requirements were raised in 2008, which led to a decrease in liquidity, resulting in money supply growth dropping by 42% (IMF 2008). In 2003–2010, monetary policymakers in Libya considered a recommendation given by the IMF in 2003 to reform the Libyan economy, including its monetary policy framework and financial sector. The IMF noted at the time that macro-economic policies should play a significant role in improving real GDP and reducing inflation in Libya (IMF 2008).[15] The Libyan uprising of 2011 affected economic recovery in 2003–2010 (Ahmouda 2014), as will be explained in Section 2.2.6.

[15] The current study tests the recommendation of IMF in Chapter 7.

2.2.6 Economic developments since the uprising (2011-2016)

The uprising of 2011 represented a social turning point in Libyan history (Khan & Mezran 2013). Positive outcomes were expected in terms of an improved standard of living for the Libyan people and the country as a whole (e.g., in the form of education, health, infrastructure, employment opportunities, higher real GDP growth and lower inflation rates) (Khan & Mezran 2013; Alimohamed 2014). However, the result was the reverse of this. Real GDP declined significantly during this period, particularly in 2011, triggering civil unrest. Higher inflation also ensued (IMF 2012; Alimohamed 2014; Etelawi et al. 2017). These outcomes can be attributed to a decline in oil production and revenue arising from the negative impact of the civil war on oil infrastructure, and as a result of the UN-sanctioned freezing of Libya's foreign assets (Arab Monetary Fund [AMF] 2013). These effects were transferred to the rest of the economy and then to total GDP (IMF 2012), since non-oil sector projects remained largely financed by oil revenue (Ahmouda 2014). Non-oil output growth declined by 50% in 2011 compared to 2010. Further, most businesses and services were closed at that time due to interrupted economic activities, when around 600,000 foreign workers fled Libya during the first months of the revolution and shortages of food and cash were reported in parts of the country (World Bank 2013). The lack of consumer imports generated shortages and expanded black markets. Since then, the country has imported consumer goods to fulfil domestic demand, which has declined significantly, as did domestic production in 2011–2016 (Cevik & Teksoz 2014). This led to a 16% increase in the food price index and contributed to a 20% increase in inflation during 2011–2016 (Khan & Mezran 2013; African Development Bank 2017).

After the Transitional National Council (TNC)—an official government body—took control of Libya at the end of 2011, the economy began to recover (Khan & Mezran 2013). The oil sector subsequently improved and some international oil companies, such as Eni and Total, returned to their operations. Oil production again increased to 1.5 million barrels per day, 59% (Salem et al. 2016). Libya took several steps to improve the nation's security and economic situation by rehabilitating oil production to come close to its pre-war level (IMF 2012). However, the recovery in GDP was attributable almost entirely to the increase in oil production rather than any specific economic measures taken by the government (IMF 2012).

In 2012, non-oil real GDP grew by 30%, driven mainly by the non-tradeable sector, which was involved in the reconstruction, process, specifically the construction sector in the safest cities. The main contribution of the non-tradeable sector came from two main sub-sectors, services and private construction (housing), which comprised 28% of total real GDP (World Bank 2013). Real GDP growth recovered from –4% in 2011 to 2% in 2012. In 2012, the external current account and fiscal balances registered surpluses of 21% and 36% of real GDP, respectively (World Bank 2014). However, improvements in the nation's security and economic situation in 2012 did not continue because of political instability arising from ongoing conflict between the Libyan army and Islamic state rebels, which began in late 2013 and continues to the present. This led to the closure of most oil fields, loading facilities and pipelines, resulting in a reduction in the production of crude oil, which fell to its lowest level on record, around 0.64 million barrels per day, on average, over 2013–2016 (OBEC 2016). Libya's oil fields deteriorated without regular inspections, and maintenance and production from some wells became impossible as a result of damage to facilities (Khan & Mezran 2013). Oil-related infrastructure was also devastated. Oil prices halved from US$102 in 2013 to US$44.3 per barrel in 2016; therefore, oil revenue decreased from LYD$4.77757 billion in 2013 to LYD$10.665.5 billion in 2016—a decline of –77% (OBEC 2016). Although the reduction in oil production was offset by higher oil prices throughout 2011–2014, approximately US$99.5 per barrel on average (Etelawi et al. 2017), oil revenue was adversely affected significantly again by the fall in oil prices in 2016.

The new governments[16] were preoccupied with political and security issues and so did nothing in regard to economic matters (Khan & Mezran 2013; OPEC 2016). Oil revenue remains key to economic growth (Etelawi et al. 2017); therefore, other macro-economic factors such as real GDP growth, money supply, fiscal budget, inflation and the trade balance were inevitably affected during 2013–2016. The poor security conditions

[16] There were two governments in one state. One in the east (recognised by the UN) and another in the west. However, everything related to the economy is still as same before, controlled by the capital of Libya in the west, Tripoli. Even the services of the Central Bank and the LNOC are still conducted by central branches in Tripoli.

and blockaded oil infrastructure caused by political conflicts have continued to constrain the supply side of the economy. Destruction of infrastructure and production facilities, such as the departure of foreign workers, affected both oil and non-oil economic activities. This resulted in a shrinkage of total production (GDP), which declined by 10% during 2013–2016 (World Bank 2016; Ali & Harvie 2015). Non-oil sectors remained weak due to disruptions in the supply chains of both domestic and foreign inputs, as well as a lack of finance, which was driven by revenues from the oil sector and could have provided finance to support other sectors/activities (World Bank 2016). The lack of security has also had an impact on foreign investment for both the oil and non-oil sectors. A climate of political conflict and the absence of national security was not conducive to foreign investment. Although liberalisation of the economy by the National Transitional Council (NTC) in 2011, it did not continue due to ongoing civil war and political instability. This halted foreign investment, which brought oil investment to its lowest value: US$50 million in 2014 (IMF 2016; El-Hamoudi 2017).

The new governments also failed to increase FDI targets in the non-oil sectors. Therefore, the real non-oil sector GDP has failed to improve (see Table 2.4). The trade balance and the balance of payments (BoP) were also influenced by this economic deterioration. Since 2011, the current account has remained in continual deficit, particularly in 2011, 2014, 2015 and 2016, being –LYD5.33, –LYD9.37, –LYD5.77 and LYD$–5.43 billion respectively. Deficits in the fiscal budget were mainly derived from lower revenue from the oil sector, which declined by a fifth of the average level in the pre-revolution period, while spending remained high, leading to significant deficits in 2013–2016 (Central Bank of Libya 2016; see Table 2.6). The budget deficit rose from 43% of GDP in 2014 to 75% of GDP in 2015 (Central Bank of Libya 2016). The deficit was mainly financed from government deposits at the CBL (2016), leading to increased money supply and higher inflation (Central Bank of Libya 2016). Further, due to financing these deficits, net foreign reserves were rapidly depleted (World Bank 2016; Central Bank of Libya 2016). The BoP substantially deteriorated when oil exports and growth declined with the current account deficit. In 2015, the estimated current account deficit was 76% of GDP. Hence, net foreign reserves were rapidly depleted to finance these deficits; consequently, net foreign reserves halved from US$107.6 billion in 2013 to an estimated US$56.8 billion by the end of 2015 (World Bank 2016). The civil war,[17] deterioration in infrastructure and lack of security had an unfavourable effect on regional trade integration and economic cooperation from 2011 to 2016.

There was a temporary restoration in oil wells in 2012, which led to an increase in oil production, exports and surpluses in the current account (see Table 2.2). This recovery ceased in 2013, as old and damaged wells could not produce at desired levels (Etelawi et al. 2017; African Development Bank 2017). These economic difficulties were compounded by a lack of good governance and policies.

These difficulties were compounded by a lack of good governance and policies. The new government followed a strategy of suppressing popular discontent (Khan & Mezran 2013). That is, oil revenues were used to provide subsidies for food, fuel, electricity and higher wages (salaries) to suppress popular discontent (Khan & Mezran 2013). This strategy represented a continuation of the situation under the Qaddafi regime, especially at its final stage. Thus, the budget allocation for subsidies of fuel, food and electricity increased from 11% of GDP in 2012 to 14% in 2014 (IMF 2012; Central Bank of Libya 2016). Further, wages in the public sector increased during 2012–2014 by 30 percent. Therefore, the pattern of expenditures for consumption (current expenditure) represented about 80% of total government spending, while only 20% was allocated to development expenditure (IMF 2012; Central Bank of Libya 2016). During this period, public investment in health, education, electricity, water and sanitation services was inadequate, contributing to lower real GDP growth of non-oil sectors, which was estimated at –4% on average over 2011–2016 (IMF 2012; Central Bank of Libya 2016; see Table 2.3), especially in the non-oil sector, resulting in higher inflation. Inflation ranged between 18% and 22% in 2011–2016.

Increased government expenditure and lower oil revenue during 2011–2016 (Moussa 2005; Yahia & Saleh 2008; Ali 2011; Fargani 2013; IMF 2016) turned the budget

[17] The conflict between the government and the militias from 2011–2017 over oil resulted in damage to oil infrastructure, leading reduced oil production and exports (IMF 2012; Etelawi et al. 2017; African Development Bank 2017).

surpluses of the 2000s into deficits. This was particularly noticeable in 2011, when the deficit rose to 19% of GDP (see Table 2.3).

The country's exchange rate policy also had an important impact on the stability of the domestic economy during this period. The appropriate exchange rate regime for the country depended on the effects of non-oil exports on real GDP and inflation. The exchange rate devaluation policy that applied in the previous period (2003–2010) was pursued again during the period. It was not effective and led to undesirable consequences, such as increased import prices, decreased foreign exchange reserves and rising inflation (IMF 2010; Khan & Mezran 2013; African Development Bank 2017). The primary objective of the strategy of enhancing exports of the non-oil sector was also not achieved. From 2011–2016, the Libyan dinar fell significantly compared to other currencies (Libyan Organisation of Policies & Strategies 2016). This pushed the country to return to two exchange rates, an official exchange rate and the black market exchange rate that operated in the 1990s.

The Libyan dinar witnessed a substantial drop in the black market: LYD4 = US$1 in 2011–2013 to LYD8 = US$1 in 2014–2016 (Libyan Organisation of Policies & Strategies 2016). The nominal official exchange rate of the LYD against the US$ continued to weaken and devalued by more than 9% in 2015. In the parallel market, the LYD depreciated by around 160% due to restrictions on foreign exchange transactions implemented by the CBL (IMF 2016). There were also secondary reasons behind the LYD collapse (see IMF 2010; Libyan Organisation of Policies & Strategies 2016; African Development Bank 2017). The first was the decline in oil exports and revenue (in foreign currency), which reduced net foreign exchange reserves, devalued the exchange rate and increased imported inflation (Cevik & Teksoz 2014; African Development Bank 2017). A second reason related to the civil war and the absence of security, which resulted in an increased trend towards illegal trade in currencies and profits through the foreign exchange black market (Libyan Organisation of Policies & Strategies 2016). This also led to the decreased value of the LYD against the US$ in the black market (Libyan Organisation of Policies & Strategies 2016). Third, the monetary authority did not respond correctly to this problem; policymakers seemed to be waiting for the Presidential Council and its government to manage the issue (African Development Bank 2017). Therefore, since

2011, there has been no clear monetary policy, which has adversely influenced the entire macro-economy. The African Development Bank (2017) indicated that Libya should urgently draft a clear monetary policy, and support the independence of the central bank and its power to manage reserves and develop the financial sector. The IMF (2008), Khan and Mezran (2013) and Alimohamed (2014) further suggested that the monetary policy of Libya should work in conjunction with fiscal policy to improve the macro-economic situation to lower the inflation rate and enhance economic growth (IMF 2008; Khan &Mezran 2013; Alimohamed 2014). This is one of the key issues to be explored in this study and will investigated in more detail in Chapter 7. Next section will focus on the key pillars of civil war scene in Libya.

2.2.7 Civil war scene and main pillars (2011 and onward)

The civil war started in Libya in 2011 and has severely affected the country in political, societal and economic ways. The effects on each of these essential pillars of responsible and effective governance will be analysed in turn and then the way forward, according to the recent World Bank group's directives, will be considered.

Political Pillar

Authority in Libya is split into two state institutions based along geographic lines; one in the west located in Tripoli and the other is in the east and located in Tobruk. This separation of power during the civil war has damaged the country. Protracted conflicts and the lack of effective official legislative authority to control the whole country resulted in decreased national security. These internal conflicts have had external national security consequences in terms of unprotected borders. Irregular and undocumented migration has increased as Libya has become a transit point of unofficial migration from Africa to Europe (International Bank for Reconstruction and Development 2019). Increased unregulated migrators, smugglers and militia have led to a proliferation in criminal groups and illegal activities.[18] This has caused political leaders to be vulnerable to criminal groups that further undermines efforts to build

[18] Even though the Libyan *National Army* (LNA), based in Beyda/Benghazi, under the leadership of a general, Khalif Haftar, continues to provide a semblance of stability in some areas, rival entities compete for power. Fragmentation

functioning political and administrative institutions. So strategies to promote economic and social development have been obstructed (Chivvis & Martini 2014).

Societal-microeconomic Pillar

The civil war was responsible for deteriorating public provision of basic services including utilities, health and education. The conflict damaged water and power infrastructure in an already aging system. Libyans have also suffered from a lack of access to good health care. The health system is adversely affected by significant shortages of health personnel, worsened by the flight of foreign health workers due to insecurity (IMF, 2012). Further, due to the damage of the health infrastructure, almost 20 per cent of essential public hospitals and medical clinics have closed; and less than one-sixth of primary health facilities hold sufficient stocks of basic medications. Education provision is very low and education infrastructure, sector governance and access to quality education has been adversely affected. The United Nations Children's Fund (UNICEF 2018) reports that about 550 schools (11 per cent of the total) are not operating properly, affecting access to education for an estimated 279,000 children. The psychosocial needs of children, educators and administrators have increased and are estimated as requiring intense attention. Therefore, the civil war has severely affected the societal framework of Libya and the microeconomic supply side of the economy, which affects economic growth and employment. There has been a decline in non-oil sectors activities and increasing unemployment, including youth participation in economic activity declining from 72 per cent in 2012 to 48 per cent in 2015 (International Bank for Reconstruction and Development 2019). Given the focus of this thesis, the adverse macroeconomic effects will be considered.

The Macroeconomic Pillar

The macroeconomic institutions set up during the Qaddhafi period deliberately incorporated inefficiencies, redundancies, waste and an absence of transparency.[19] It is

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and dysfunction resulted in exacerbation of an insecure environment (International Bank for Reconstruction and Development 2019).

[19] This regime was in power in Libya for more than four decades from 1969-2011.

discouraging that these practices endured unreformed during the following political vacuum after Qadhafi's ousting in 2011. In fact, it

has become more entrenched (Pack 2019) because the situation became even more complicated at the time of the revolution. The resulting civil war plunged the Libyan economy into a tailspin. Reconstruction to stabilise the economy was expected but not delivered and economic growth deteriorated from 2011-2016 with real GDP falling by 4 per cent and inflation exceeding 20 per cent (Vandewalle 2012; IMF 2016).

A drop in oil production, the country's leading product and source of revenue, led to an overall fall in real GDP by 62 per cent in 2011 (IMF 2012). Weak government institutions, corruption, poor infrastructure and political instability contributed to shrinking FDI in both the oil and non-oil sectors (Abushhewa & Zarook 2016). This was reinforced during the period 2011-2016 with lower domestic private investment, contributing to lower output in the domestic economy (Hamoudi 2017; Alfergani 2010).[20] Additionally, the UN-sanctioned freezing of Libya's foreign assets in 2011 worsened the situation (Khan & Mezran 2013). There was also a substantial reduction of Libya's oil production capacity resulting from damage to the largest oil fields including Es Sideras during the war (IMF 2012; OBEC 2016). Thus, oil exports were affected (IMF 2012; Central Bank of Libya 2016; Etelawi *et al*. 2017).

Due to the dependency of the rest of the economy on the oil sector, real non-oil GDP also declined by 52 per cent in 2011. The budget turned from surplus to a deficit of 19 per cent of GDP in 2011 and the external current account surplus fell to 9 per cent of real GDP. This surplus resulted from a decrease in both exports and imports to more than half of that experienced in 2010, but exports declined by less than imports as shown in Table 2.7 (IMF 2012; OBEC 2016). Whilst reduced spending on imports (due to the lack of funding and foreign exchange reserves to finance imports) mitigated the fall in the trade balance

[20] Libya should, therefore, renew its infrastructure, and such change should be accompanied by a comprehensive reform in all laws and policies in regards to foreign investment which should at the same time be associated with a higher degree of transparency. Such a move would reduce concerns about investing in Libya and therefore, attract international attention and foreign investment to all economic sectors of the country (Hamoudi 2017; Alfergani 2010). This would create a conducive economic environment to encourage the growth of the private sector and attract FDI when the civil war ends.

surplus, it led to a lack of consumer goods in the domestic market (Khan & Mezran 2013). Food

prices jumped by nearly 16 per cent during the period 2013 – 2016 which contributed to the inflation rate rising to 22 per cent in 2016 (Central Bank of Libya 2016; Etelawi, et al. 2017). To compensate for the decline in economic growth and the rise in inflation, average public salaries rose fourfold since 2011, which has dramatically increased fiscal budgetary pressure.

Whilst government revenue, expenditure and the fiscal budget balance had become extremely vulnerable to world oil price shocks (Fargani 2013; Ahmouda 2014), the overall fiscal stance is under severe stress with high expenditure and volatile oil revenues. Oil revenue improved significantly from 36 per cent of real GDP in 2017 to 50 per cent in 2018. However, this would barely cover the public salaries and fiscal expenditure on goods and services. Other macroeconomic factors felt the impact since the budget deficit had to be financed by borrowing money from the Central Bank. The money supply increased dramatically increasing aggregate demand, especially for consumption and imported goods (Ali 2011; Khan &Mezran 2013), putting upward pressure on inflation (Ali 2011; International Bank for Reconstruction and Development 2019).

Monetary policy lost its independence and has become a less potent policy instrument (Alimohamed 2014). The Central Bank of Libya has struggled to fulfil its core responsibilities of managing the currency, money supply, and interest rates and overseeing commercial banking. While there is no IMF program, the IMF is monitoring the situation closely in collaboration with the Central Bank of Libya. Even though the private sector attempted to improve in recent years, it is still emerging, uncompetitive, and state-dominated, subjected to a poor regulatory environment, and cronyism. The private sector is further constrained by the political and security crises, damaged infrastructure and the lack of good trade networks. Therefore, the economy is still oil-dependent and heavily influenced by world oil price shocks (International Bank for Reconstruction and Development 2019). It can be concluded that the baseline macroeconomic scenario is one of continued macroeconomic fragility with a heightened risk of a full-scale crisis occurring. According to Pack (2019, p. 21),

> 'The root-causes of the ongoing civil war are not political or military. They are economic'. The time for bold, but inexpensive action, is now. Constituting a research team for a mapping exercise and commissioning forensic audits should be politically palatable to all Libyan factions and all major international players'.

The next section will consider the efforts of the international community, including multilateral economic organisations and the World Bank, to provide a program of support in order to help the Libyan economy to recover.

The Way Forward from 2020

The World Bank intends to improve the Libyan economy under a three-year engagement from 2019–2021. It aims to address the essential urgent priorities for recovery, including the lack of data and analytics, while building the foundation for longer-term transformation. The World Bank Group support will focus on technical assistance (TA) and reimbursable advisory services (RAS). The World Bank will be working with a broad group of partners, which include the African Development Bank (AFDB), European Union (EU), France, Germany, Italy, UK and various UN agencies. The partners will work together to set up strategic arrangements around macroeconomic stability, governance, basic services (health, education, electricity, and water and sanitation), private and financial sectors' development. Recognizing the key role of private sector development in economic recovery, the group will work jointly with the International Bank of Reconstruction and Development (IBRD), International Finance Corporation (IFC) and the Multilateral Investment Guarantee Agency (MIGA).

The strategic framework of the selected two pillars for the broader group is summarized in Diagram 2.1. Support for capacity development is key to this program.

Pillar I: Accelerating Economic Recovery

(i) create a foundation for macro-fiscal stability,

(ii) strengthen governance and the core functions of public administration, and

(iii) develop the private and financial sectors.

Pillar 2: Restoring Basic Service Delivery

(i) improve electricity supply and sustainability,

(ii) improve access to health care, and

(iii) enhance access to quality education (for more information see Report of International Bank for Reconstruction and Development Report 2019)

***Diagram 2.1*: World Bank key strategic framework for Libya - 2020s**

Source: International Bank for Reconstruction and Development Report (2019, p.15)

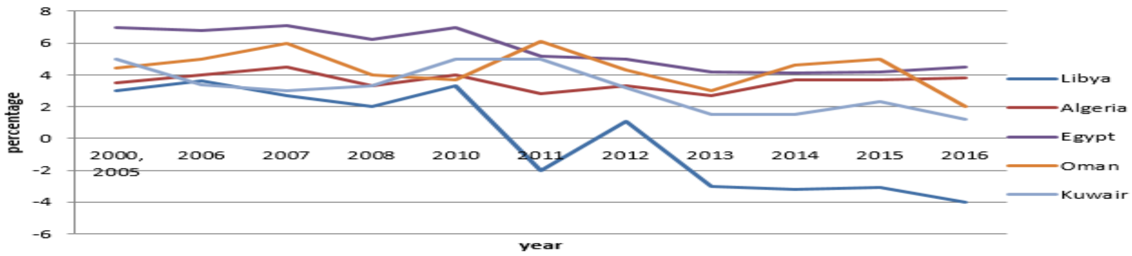
The previous discussion has demonstrated that Libyan macro-economic policies and plans since the 1970s have not been effective. All these plans aimed to diversify the structure of the economy so that the country did not have to rely on oil for economic stability, as this sector is subject to external shocks and fluctuations. It can be argued that even after the uprising, the oil sector has remained the leading sector of the economy and the primary financial source, despite having been significantly affected by the civil war and oil price shocks (Etelawi et al. 2017). Therefore, the traditional issues facing Libya (lower GDP growth and higher inflation) were further exacerbated. Section 2.3 summarises the main contemporary issues and challenges facing the Libyan economy, drawing upon comparisons with other MENA countries when appropriate.

2.3 Contemporary Issues and Challenges Facing the Libyan Economy

Based on the historical review of the Libyan economy in Section 2.2, this section aims to identify the main contemporary issues and challenges facing the Libyan economy and which motivate the current study. Like many oil-producing/exporting countries of MENA, Libya has a poorly performing economy in terms of low real GDP growth and a high inflation rate. As previously shown, Libya produces more than 2.7 million barrels of high-quality oil a day, exports a considerable amount of this and generates significant oil revenue. However, Libya has had the lowest annual real GDP growth and the highest inflation rate of the oil-exporting MENA countries (see Figures 2.5 and 2.6), which have comparable conditions in terms of economic development status, oil output production, imperfect financial systems and monetary policy operations (Khan & Mezran 2013; IMF 2014). This includes countries considered to have been most affected by Dutch disease in MENA, including Algeria and Oman (IMF 2014, Fargani 2013, Al-Saqri 2010).

Figure 2.5 shows that GDP growth in Libya was approximately 4% or less from 2000–2010, dropping sharply to –4%, on average, from 2011–2016, making it the worst performing MENA country (World Bank 2014). Figure 2.6 illustrates that Libya has the highest inflation of all MENA countries, with an average inflation rate ranging from 8-22% during 2000–2016 (World Bank 2014; Central Bank of Libya 2016). Economists (IMF 2008, 2012; Khan & Mezran 2013; Alimohamed 2014; Li 2013; Edwik 2007; Ali & Harvie 2017; Etelawi et al. 2017) have highlighted the main factors that have contributed, directly and indirectly, to low GDP growth and high inflation in the country. These include: resource curse issues, particularly Dutch disease, an inappropriate balance of macro-economic policies in response to oil shocks and political instability.

Figure 2.5. Real GDP growth in comparable MENA countries, 2000–2016.

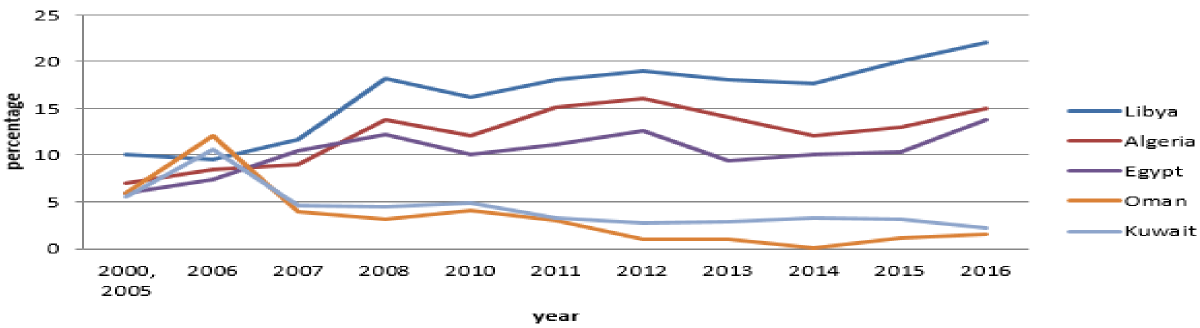


Source: World Bank (2016).

2.3.1 Resource curse and Dutch disease in particular

In most MENA countries that are well endowed with oil, economic growth over a long period has had a tendency to be slower than that of countries that are less-resource endowed, due to the so-called 'resource curse' (Auty 1993; 2001, 2003; Sachs & Warner 1997; Gylfason 2001a; Hasanov 2013; Ahmouda 2014; Smith 2015). The resource curse phenomenon indicates an association between the abundance of oil and poor economic performance as measured by GDP growth and inflation. The resource curse in developing resource-rich countries is based on a number of factors. These include political conflict that uses resource revenues for regional, ethnic or religious interests, unequal distribution of the wealth gained from resources, corruption and 'rent-seeking' behaviour by economic agents, and weak government institutions incapable of managing resources effectively (Harvie 2019).

Figure 2.6. Inflation rate in selected MENA countries, 2000–2016.



Source: World Bank (2014, 2016); Central Bank of Libya (2016).

Although Libya has an abundance of oil, its relative economic performance in terms of real GDP growth and inflation has been noticeably poorer than that of less-resource abundant MENA countries, such as Egypt, over the long run (see Figures 2.5 and

2.6; Li 2013; Khan & Mezran 2013; IMF 2016). The relationship between oil abundance and poor economic performance in Libya can be explained by both economic and non-economic factors (corruption, poor government administration, poor policymaking and, significantly, the role of Dutch disease, which has contributed to a slowdown in economic growth particularly in export-oriented sectors such as manufacturing and agriculture) (Ali 2011; Fargani 2013; Ahmouda 2014; Alimohamed 2014). It is reasonable to infer that the adverse impacts of the oil sector on the output of the non-oil sector, non-oil exports and real non-oil GDP are consistent with the appreciation of the real exchange rate as emphasised by the Dutch disease effect. This forms the focus of this research.[21] However, other factors should also be recognised.

A development policy focus on the public sector rather than the private sector has encouraged rent-seeking behaviour, with considerable income and revenue being lost or misallocated through activities such as corruption and civil conflict (Ali 2011; Mda & Emhemed 2016), resulting in many poorly performing and loss-making industrial projects (Alqadhafi 2002; IMF 2005). Oil wealth was transferred from the general population to a small group of elite, politically connected individuals, a symptom of weak and corrupt governance and institutions, resulting in resource misallocation and reduced economic growth (Mauro 1995; Ali 2011; Mda & Emhemed 2016).

The focus of this study, however, is only on the role and contribution of the Dutch disease component of the resource curse, which emphasises the impact of economic, and not social factors, on economic outcomes. Dutch disease will be explained theoretically in Chapter 3 and empirically in Chapter 5.

2.3.2 Fiscal budget issues, the limited role of monetary policy and higher domestic prices

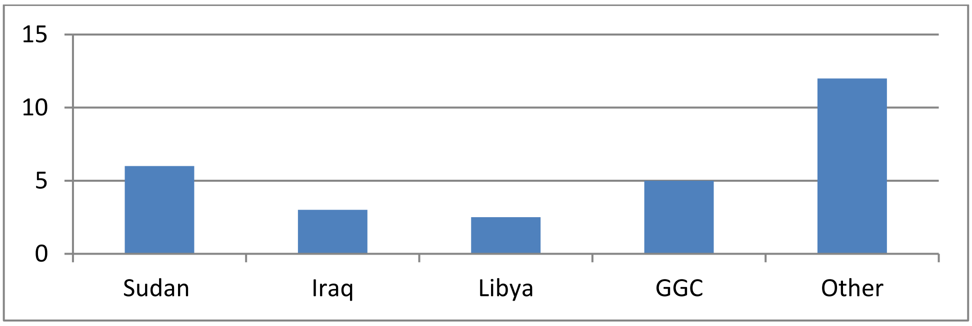
According to Alimohamed (2014) and the African Development Bank (2012), differences between the rates of growth of public revenue and public expenditure were the consequence of poorly devised and unsustainable development plans, and unrealistic

[21] While adverse economic outcomes are also likely to be associated with political instability, rent-seeking behaviour, poor governance and decision-making (Frgani 2013; Ahmouda 2014), they are beyond the scope of this research.

oil price expectations. Higher budget deficits forced the government to borrow from the central bank to finance these. As an oil-based economy, Libya has been plagued by the need to borrow from the central bank or print money to finance public spending and the deficit in the fiscal budget, resulting in faster growth of money supply and higher inflation (Ali & Harvie 2017). At the same time, revenue from non-oil sectors to enhance public revenue was insignificant because the tax system relating to these sectors was non-existent or underdeveloped, and excessively dependent on oil revenue.

Oil revenue strengthens the exchange rate, which deteriorates the competitiveness of the non-oil tradeable sector and tax revenue generated from it. While oil revenue itself is not sufficient, in general, to produce fiscal surpluses, it is easier to collect. Libya had the lowest non-oil tax revenue among exporting countries, representing less than 5% of real GDP during 1990–2016 (Eken 1997; IMF 2014a; see Figure 2.7). As noted by Ali (2011), the country does not have a financial system in which government bonds can be sold to finance deficits. Thus, Libya finances its deficits by borrowing money from the central bank, which is equivalent to monetary accommodation and the printing of money (Ahmouda 2014; Ali & Harvie 2015). This typically results in a rising inflation rate since domestic supply has been unable to keep pace with domestic demand (Ahmouda 2014; Ali & Harvie 2015).

Figure 2.7: Non-oil tax revenue (in % of real GDP) during 1990–2016, various countries.



Source: IMF (2014, 2016).

This makes the public budget in the economies of oil-producing countries an indicator for the level of domestic economic activity, or a tool to increase money supply (Alimohamed 2014). However, borrowing from the central bank to finance a fiscal budget deficit may be the only option for countries with an inadequate taxation system and an underdeveloped financial market, as in the case of Libya (Bindsei 2004; Ruhaet 2010). Monetary policy subsequently becomes dependent on fiscal policy. Moreover, monetary policy is ineffective under a nominal managed exchange rate regime and contributed to higher inflation in Libya from 1980–2016 (IMF 2008; Ruhaet 2010; African Development Bank 2017).

The response of the interest rate to changes in GDP growth and inflation was not likely not to be instantaneous (Ali 2011). This can be observed through relative lagged changes in the interest rate during most periods, changing only annually (see Table 2.6). In most cases, a lower interest rate[22] reduces the cost of holding money and encourages aggregate demand by increasing both investment and consumption spending, leading to increased output and economic growth (Mutnda 2012). However, for Libya, such a strategy would likely lead to increased consumption (Emhemed 2016), which can then lead to reduced allocation to private sector investment. Although the CBL has made some autonomous changes in its measures to reactivate the economy, such as reducing the discount rate and interest rates on loans (IMF 2008; Ahmouda 2014), the primary monetary variables followed the same trend. Therefore, they shadowed the same pattern of oil price shocks (Fargani 2013; Ahmouda 2014). The accelerated growth in money supply is primarily due to the substantial increase in net foreign assets (foreign exchange reserves from exporting oil) and the rapid growth in public spending (paid for by monetary accommodation) with limited scope for independent monetary policy, as noted previously.

Based on the discussion above, it can be argued that the oil-based Libyan economy is affected by Dutch disease and an inappropriate balance of macro-economic policies in response to oil shocks (IMF 2008; Khan & Mezran 2013; Alimohamed 2014). Given the serious issues facing the oil-dependent economy of Libya, research is required to examine linkages between Dutch disease due to oil price shocks, macro-economic policies, real non-oil GDP and domestic prices, and the objective of providing evidence on appropriate monetary and fiscal policies to promote low economic growth and higher domestic prices

[22] Changes in the interest rate should have a significant impact on aggregate demand and supply in the economy (Al-Raisi et al. 2007) through influencing private sector consumption and investment.

in Libya. Therefore, an empirical analysis is required, and will be conducted in Chapters 5, 6 and 7.

2.4 Conclusion

The aim of this chapter was to provide a historical review of oil development and its broader influence on key macro-economic variables and policy in the Libyan economy, focusing on contexts most relevant to attaining the objectives of this study. This chapter highlighted six specific periods in 1950–2016 that included the pre-oil era, oil development/boom period, volatility of the international oil price period, UN economic sanctions period, post-UN economic sanctions era and the post-Qaddafi period/economic developments since the uprising and civil war. The discussions regarding these periods conclude that Libya is one the largest oil-producing/exporting countries in the MENA group, and is seventh on a list of countries by oil reserves among OPEC member countries. Libya is an oil-based country, with about 90% of total government revenue coming from oil revenue. The current account, government revenue, government expenditure and overall fiscal budget are extremely vulnerable to world oil price shocks (Fargani 2013; Ahmouda 2014). Other macro-economic factors, such as money supply, inflation and the trade balance, have also felt the impact of this reliance since the budget deficit must be financed by borrowing from the central bank (Ali 2011). The managed exchange rate system also means that money supply cannot be controlled effectively. The BoP deficit/surpluses results in a fall/rise in foreign exchange reserves and an increase in money supply. Increased money supply can drive inflation through increased aggregate demand, relative to sluggish domestic supply growth, especially the demand for consumption and imported goods (Ali 2011). Monetary policy has lost its independence and potency as a policy instrument (Alimohamed 2014).

Libya has experienced lower GDP growth and higher inflation for a long time compared to other MENA countries, which is indicative of Dutch disease effects and the resource curse more generally. In Chapter 3, the ‘resource curse’ phenomenon, with a focus on Dutch disease (which is most relevant to this study), will be discussed in detail.

Chapter 3: Literature Review

3.1 Introduction

The main aim of this chapter is to review the extant related literature and provide a solid foundation for investigating Dutch disease and identifying appropriate macro-economic policy responses to be used in the theoretical model (see Chapter 4) and empirical chapters (Chapters 5, 6 and 7). This will highlight relevant hypotheses, methodologies, including models and methods, and research gaps. This chapter includes relevant theoretical and empirical contributions to the literature. These are divided into subsections, comprising literature on Dutch disease and macro-economic policies.

In parallel with the analysis of Dutch disease, it is important firstly to discuss the debate among economists about the existence, in some natural resource-rich countries, of the 'curse of natural resources'. This chapter will then outline the concept of Dutch disease, which is considered an essential component and economic channel of the resource curse. As demonstrated by the literature, the method used to investigate Dutch disease differs slightly from that used to investigate other resource curse components (Davis 1995; Stijns 2005; Brunnschweiler & Bulte 2008). This will be further explained in later in the chapter.

Section 3.2 comprises an overview of the resource curse and its components, while Section 3.3 explains Dutch disease and related channels. In Section 3.4, empirical evidence will be reviewed and the research gap will be identified and evaluated. Section 3.5 provides a brief conclusion.

3.2 An Overview of the Resource Curse and Its Components

The expectation of resource-abundant countries is that they will retain economic advantages provided by their resource/s and achieve higher economic growth than will resource-poor nations (other conditions being similar). This expectation has, however, been widely contradicted by empirical evidence suggesting that in the long term, resource-rich countries report slower economic growth than do less resource-abundant countries. Auty (1993), who initially raised the concept of a 'resource curse', presented a comparison in which resource-abundant countries achieved slower rates of economic growth and wellbeing than resource-poor countries. Sachs and Warner (1995) later studied this using empirical evidence. Auty (1993) elucidated the resource curse as the paradox of plenty, whereby nations with plenty of natural resources (e.g., fossil fuels and certain minerals) tended to have slower economic growth and worse development outcomes than countries with fewer natural resources. In other words, the existence of natural resources does not necessarily guarantee, and generate benefits for, economic growth (Auty 1993, 2001; Sachs & Warner 1999).

The resource curse phenomenon has generated intense interest and has been investigated by prominent scholars, who have found support for the resource curse and its effects on growth in numerous resource-rich economies. Further studies by Sachs and Warner (1997, 2001), Tornell and Lane (1999), Auty (2001), Mehlum *et al*. (2006 a, b), Wu *et al.* (2010) and Shera *et al.* (2014) and provided further empirical evidence to support the existence of a resource curse. Much of the evidence came from the context of developing economies. The early literature yielded a frequent observation that natural resource-rich countries tended to grow more slowly than countries lacking such resources (Sachs & Warner 1997; Auty 2000, 2001). This assertion has been questioned in more recent literature. There are many examples of resource-rich countries performing well, such as Norway (Gylfason 2001) and others doing poorly, such as the MENA region, Nigeria and DR Congo (World Bank 2003; Mehlum et al. 2006 a; Engen et al. 2012; Martin & Subramanian 2003; Opeyemi 2012).

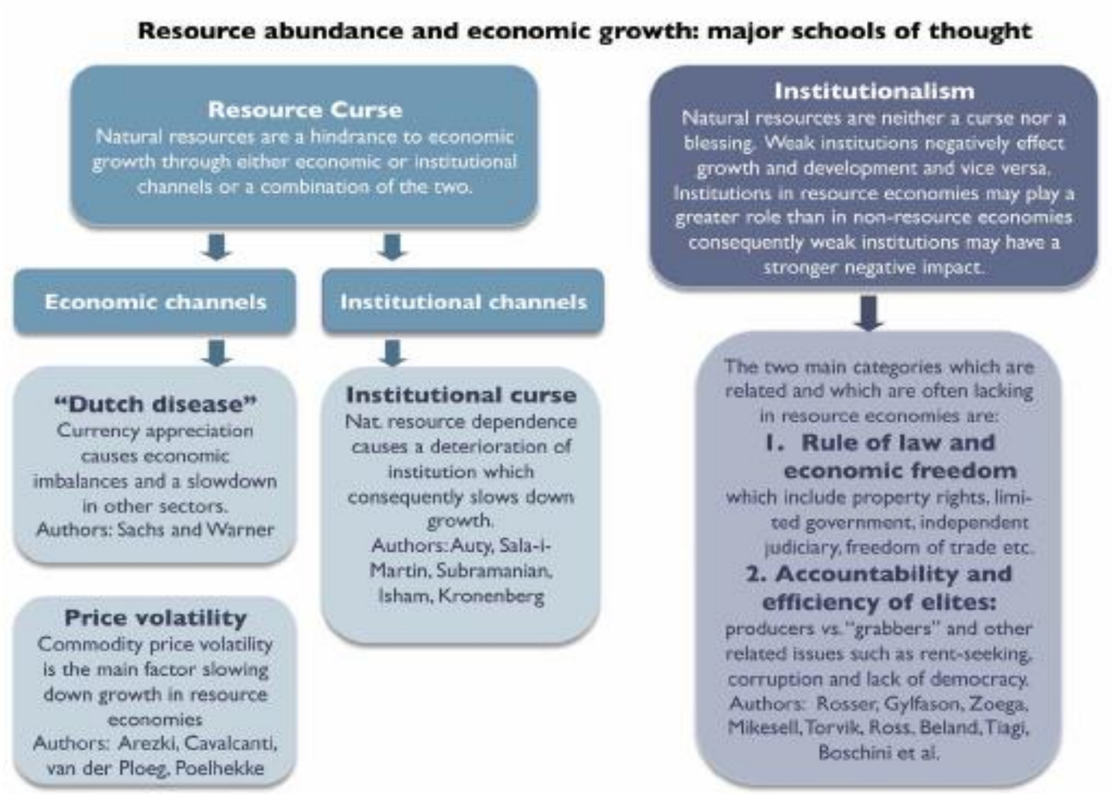
In general, substantial revenue from natural resources has two impacts on the domestic economy that can be respectively described as a 'blessing' or a 'curse' (Auty 2001). If massive income from natural resources is used to develop non-resource sectors, the existence and exploitation of a country's natural resources is a blessing. This is because investment in education, health, productivity and manufacturing sectors increases total output and enhances economic growth. Thus, the domestic economy can develop (Ali & Harvie 2013). Sachs and Warner (1995) argued that the boom in natural resources led to a positive impact in countries such as Ecuador and Norway. However, Norway has different conditions than other resource-abundant nations. At the time of its natural resource discovery, the economy of Norway was well organised with a well-established democracy and a well-educated population (Engen et al. 2012). The country also adopted an excellent method to accumulate and administer its natural resources: a sovereign wealth fund (SWF), to which all resource revenue was allocated and invested. All these factors have contributed to higher economic growth in Norway compared with many other resource-abundant countries, such as MENA region nations and DR Congo, which still suffer from a resource curse (Engen et al. 2012). The existence of a well-developed economy and subsequent avoidance of the resource curse in Norway demonstrates the above point that investment in infrastructure and non-resource sectors, not reliance on revenues from natural endowments, is a necessity for sustained growth; Norway offset the decline in its non-oil exportable sectors. It is essential to use the revenue from non-renewable resources to invest in income-earning assets that will generate income after the depletion of natural resources. In this context, good governance, including effective policymaking and sound institutions, and little corruption were key factors in offsetting resource curve effects (Gylfason 2001). The existence of natural resources has supported many developed countries, particularly in the initial stages of development. The UK and Germany obtained significant benefits from deposits of ore and coal during the Industrial Revolution, which enabled rapid development through diversification of their economic bases (Sachs & Warner 1995, 1997).

Conversely, the existence of abundant natural resources can negatively affect economic growth in many resource-rich countries, regardless of their development status (Sachs & Warner, 1995, 1997, 1999). Developing countries, such as those in the MENA region and Latin America, and developed countries such as Russia experienced lower or average economic growth for a prolonged period. In these cases, the existence of natural resources was a ‘curse’ in terms of negative impact on growth, non-oil tradeable sectors and limited jobs growth (Papyrakis & Gerlagh 2004). Many factors contributed to this problem: poor institutions, corruption, rent-seeking behaviour, narrowly spread benefits, less-educated workers and poor macro-economic responses relating to the abundant resources. However, the influence of these factors differs among countries.

Auty (2001) examined data from 1960–1997 to investigate differences between Asian and Latin American industrialisation experiences, and found manifestations of the natural resource in Latin America. The Asian industrialisation experience has been far more successful. Auty (2001) argued that Asian countries are less endowed with resources, but despite this, they achieved higher rates of economic growth. Auty (2001) attributed the difference to the resource curse effect on Latin American countries. For example, in the 'Asian tiger' economies—such as South Korea, Hong Kong, Singapore and Taiwan, which have few natural resources—economic growth has been high and sustained, enabling high living standards for citizens (Sachs & Warner 1997; Auty 2001). Abundant resources can result in low economic growth in resource-rich countries that suffer from some macro-economic, institutional and policy challenges related to the natural resource sector, so these factors (not just the resource itself) are the problem (Sachs & Warner 1997; Auty 2001). Kaznacheev (2013) summarised the main dimensions of the resource curse (see Figure 3.1). This diagram shows the resource curse theory and not the institutionalism school of thought. The institutionalism concept is an alternative explanation of the poor performance of resource-abundant economies. However, the focus of this section is the resource curse concept.

According to Kaznacheev (2013) and Harvie (2019), several factors explain the existence of the resource curse and its adverse impact on economic growth in resource-rich countries, but particularly in developing countries. Political conflict financed by resource revenues can arise from vested regional, ethnic or religious interests. Unequal distribution of resource revenue benefits, when a small number of privileged individuals gain at the expense of the poor, can foster unrest. Corruption and 'rent-seeking' behaviour (Mauro 1995; Ali 2011) are factors of the resource curse and lower economic growth in resource-rich countries, and are associated with weak government institutions incapable of or reluctant to manage resources efficiently (Harvie 2019; Auty 2000). When the majority of revenue from natural resources is spent on illegal activities, including corruption, rent-seeking behaviour and even civil conflict associated with weak institutions, the productive activities of non-resource sectors, such as manufacturing and infrastructure, suffer through a loss of their allocated development budget (Papyrakis & Gerlagh 2004).

Figure 3.1. Summary of the impacts of resource abundance on economic growth.



Source: Kaznacheev (2013, p. 7).

This results in resource misallocation and significant income and revenue can be lost through such illegal or unproductive activities that will negatively affect supply in non-resource sectors, leading to reduced economic growth (Mauro 1995).

Therefore, low economic growth in such instances is a result of illegal economy-distorting activities that redistribute the rent of natural resources towards a group of elite individuals. This group can be the dominant group, usually attached to the domestic government, who engage in corruption and use revenue in activities related to private interests (rent-seeking) rather than to create new wealth in the economy (Ali 2011). Such detrimental outcomes tend to be more common in underdeveloped nations where there is a lack of institutional coordination and resources, accountability and transparency. Monitoring agencies may allow such actions to go unobserved. While Figure 3.1 shows more resource curse channels, the following discussion will focus on the more highly related channels detected in the literature review (see Chapter 2): rent-seeking behaviour (corruption), institutional weaknesses, political instability and Dutch disease.

3.2.1 The rent-seeking model

The rent-seeking model incorporates two sectors: a formal sector, which is the natural resource sector (e.g., oil); and an informal sector, sometimes referred to as the 'shadow' or 'grey' sector, or 'underground economy', which is created by those in crucial positions, often the dominant group although it may engage poorly paid workers. Shadow projects are not regulated, nor do they pay tax. Their existence leads to a transfer of fiscal resources from the formal sector to the shadow sector in some countries. This may appear to be beneficial. However, a country with these conditions will respond to an increase in government expenditure without a corresponding improvement in economic growth. In this instance, low economic growth is not explained by shrinkage of the manufacturing sector, as described by the Dutch disease model. Rather, it is a case of losing wealth or misallocating resources to unproductive activities during the redistribution process due to rent-seeking behaviour. Funds transferred overseas are also lost to the domestic economy, potentially hindering domestic economic development (Fonkich 2000).

Mauro (1995), Meon and Sekkat (2005) cited in Shera *et al.* (2014), Wu et al. (2010) and Li (2013) found a negative relationship between economic growth and corruption. Lower economic growth can be a result of reduced productive private investment, which affects capital stock and economic growth in the long term. Loans are very limited, especially for new investors; there is not enough money for specific manufacturers since the money is allocated to pay bribes. Bribes add to business costs, which reduces profits and limits funds for investment and development (Murphy et al. 1993). If the total value of bribe payments is high, this lowers project profits, thereby reducing normal production and development, and economic growth in the long run. Innovation also becomes stunted in such economies (Mauro 1995; Meon & Sekkat 2005; Shera et al. 2014).

Therefore, corruption reduces investment, particularly overseas investment, over time. It also reduces public expenditure to improve productivity, misallocates resources from more productive sectors (tradeable sectors) to less productive sectors (non-tradeable sectors), and adversely affects aggregate productivity in the economy. Thus, it slows economic growth and funds disappear overseas (Hsieh & Klenow 2009). Ghalwash (2014) explored the effect of corruption on the growth of the economies of 22 developing countries. Core variables, such as the index of corruption, population growth, government expenditure, level of education, investment, trade, inflation and capital formation, were used. He concluded that inefficient government expenditure and decreased investment in human capital lead to a drop in productivity and output. Further, Ghalwash (2014) noted that susceptibility of human capital to exploitation and political instability represent main channels that affect economic growth through corruption and rent-seeking behaviour. These factors waste resource revenue and lead to lower economic growth.

3.2.2 Institutional channel

Weak institutions, such as insufficiently developed private and public organisations and markets in the financial, legal and other sectors, together with poor governance (in terms of lack of supervisory authority, poor decision-making and inferior management) lead to high capital costs, low investment, low economic growth and low welfare levels (Krueger 1974; Oomes & Kalcheva 2007; Auty 2000). Despite considerable revenues from the natural resources sector, these factors negatively affect output in non-resource sectors. For instance, inefficiency of governance—including lack of transparency and monitoring in institutions like government ministries, financial institutions, government departments and market-supporting institutions—is associated with lower economic growth in resource-rich developing countries such as those in the MENA region and DR Congo (World Bank 2003; Mehlum et al. 2006 a,b; Engen et al. 2012). Although countries such as Saudi Arabia, Nigeria, Mexico and Congo are at different stages of development, they have experienced poorer economic performance due to weak institutions and their inability to channel resources into productivity-enhancing activities that affect the supply side of the economy (Mehlum et al. 2006 b).

This can also occur in Libya, but the currrent study does not model institutional channel effects; it focuses solely on the effects of economic channels.

Bhattacharyya & Hodler (2013) argue that weaker political institutions can adversly affect financial development. On the other hand, a country with better political institutions would have a financially literate population that can process complex financial information in the investment process, particularly in terms of the availability of credit associated with high natural resource revenue. In this case, the improved contribution of investment in GDP would improve economic growth. The authors provide strong empirical evidence covering 133 countries over the period 1970–2005 using IV and GMM estimation techniques. They found financial development in countries with comparatively better political institutions perform better. Countries with poor political institutions are adversely affected by poor contract enforcement so resource revenue cannot benefit the overall financial development and the GDP in the country with abundant natural resources. However, this negative effect of resource rents on financial development in countries with poor political institutions can decrease when the quality of political institutions improves.

Mehlum et al. (2006b) linked institutional quality with rent-seeking in their investigation of the impacts of rent-seeking on institutional performance and governance. They divided resource-rich countries' institutional performance into two groups: 'grabber' institutions and 'producer-friendly' institutions. The study investigated how revenue from natural resources is allocated through these institutions, as well as the capacity of these institutions to do so efficiently. The study concluded that when a country is dominated by a 'grabber' institution (due to weak rule of law, a malfunctioning bureaucracy and corruption) engaged in rent-seeking activities, where the allocation of natural resources revenue is outside the productive economy, the resource-abundant country demonstrates lower economic growth. This is because grabber institutions provoke direct wealth-grabbing: corruption, political rent appropriation, 'shady' dealings, expropriation, extortion and other illegal or ill-advised activities. In this situation, it is disadvantageous to be a producer. Thus, production and rent-seeking compete for productive activities, leading to lower economic growth due to the loss of productive activities (Mehlum et al. 2006 b; Knack & Keefer 1990; Acemoglu et al. 2001). The development of countries would be affected negatively since revenue derived from natural resources is not used to enhance productive activities (Farhadi et al. 2015; Badeeb & Lean 2017). Paradoxically, the existence of a harsh bureaucracy and a proliferation of laws that ultimately stifle legitimate productive activities may produce lower economic growth and higher unemployment rates than otherwise anticipated. The negative impact of rent-seeking institutions is amplified, leading to the transfer of resource revenue from productive to unproductive activities (Mehlum et al. 2006 b). Hence, government institutions dominated by corruption and rent-seeking behaviour are unable or unwilling to manage resources effectively.

In contrast, according to Mehlum et al. (2006b), when a country is dominated by producer-friendly institutions with greater transparency and accountability in the allocation of natural resources revenue, and there is a focus on productivity-enhancing projects, it performs better and has higher economic growth. Hence, producer-friendly institutions are productivity-enhancing institutions. Productivity-enhancing institutions with less of an impact from rent-seeking activities (institutions) can enhance economic growth and provide employment opportunities for local people when they dominate the economy, and their impact can be substantial. In these circumstances, economic growth can improve and employment opportunities can be provided by leveraging productivity-enhancing activities and passing the benefits to local people (Mehlum et al. 2006b). For example, a business-friendly regulatory environment associated with institutional reforms and an active policy to develop infrastructure promotes market linkages and efficiencies that improve real GDP. This creates employment opportunities for local people in such countries as Sub-Saharan Africa.[23] Thus, living standards of Sub-Saharan Africa can be improved (Mamo, *et al.* 2019).

Bhattacharyya and Collier (2013) used a new global panel dataset on public capital and resource revenue for 45 developed and developing countries

during the period 1970 to 2005. They found that natural resource-rich countries with good economic management and institutions could avoid the natural resource curse. However, this was not the case for resource-rich countries with weak institutions.

[23] Local people only have obtained a significant advantage from natural resources during the mining process in terms of workforce, which ended when the mining operation finished (Mamo, et al. 2019)

To conclude, it is not resources themselves that reduce economic growth, but factors such as institutional structure and competence in the resource-abundant economy. Each country in this context is different. Section 3.2.2 outlines more factors related to the resource curse issue.

3.2.3 Political issues

In addition to low economic performance, excessive spending of resource revenue on political issues can further affect the resource curse (Karl 1997; Auty 2001). In many resource-rich countries, a higher allocation of resource revenue to political issues can reduce public expenditure on productive projects, thereby affecting supply and reducing economic growth. In developing oil-rich countries, resource income may finance armed conflict or be used to raise leaders' popularity and political prominence (Ross 1999; Ross et al. 2011).

Bhattacharyya, *et al.* (2017) argue that higher resource revenue can lead to more centralisation of government, especially in relation to public spending. Nations experiencing lower levels of democratisation have lower educational and health expenditures. This spending is likely to be less than expenditures provided by intergovernmental transfers. Increasing democratisation reverses these effects. Bhattacharyya and Hodler (2010) used panel data for 99 countries during the period 1980 to 2004 to link the abundance of natural resources to the quality of the democratic institutions and how it influenced corruption. They found a significant positive relationship between resource abundance and corruption in countries which have experienced a non-democratic regime for more than 60 years. Bhattacharyya and Hodler (2010) recommend democratization as a powerful way in which to reduce the resource curse arising from corruption in resource-rich countries.

Countries such as DR Congo have few adequate institutions but an enormous income from natural resources such as oil, gold, silver and diamonds. However, this is used to bring political benefits to factional rulers by buying votes through inefficient redistributions and military expenditure. Thus, the wealth of the country is spent on political issues rather than investment in productive projects and development expenditure. This leads to lower economic growth (Mehlum et al. 2006 a,b; Opeyemi, 2012). Nigeria is another country with significant resources that performs poorly due to rampant corruption and gross inefficiency (Martin & Subramanian 2003; Opeyemi 2012).

In some cases, low economic growth among resource-rich countries occurs when the government is incapable of providing robust security. The abundant-resource income that flows through corrupt channels and the shadow economy stimulates violence, theft and can finance rebel groups, and even encourage civil war. Production and export of other domestic commodities is affected by civil conflict (even more so than drought and flood), adversely affecting economic growth and the country's development due to the continuance of civilian violence that is mainly financed by resource revenue (Collier & Hoeffler 2000, cited in Mehlum et al. 2006; Costello 2018). Therefore, resource abundance in some African and MENA countries is exploited by non-democratic ruling parties to maintain power, and thus provides no economic development and growth. Natural resource wealth is detrimental because it is allocated to combat the prospect of democratic regime change (Eifert & Gelb 2002; Ross et al. 2011). This adversely affects productivity projects and economic growth. Since many MENA countries continue to be characterised by limited transparency, accounting and accuracy (even after the 'Arab Spring'), greater socio-economic justice, transparency and a more democratic regime must be a priority of MENA politics (El-Katiri & Fattouh 2015). In some studies, democracy has been shown to have a moderating effect on corruption, institutional efficiency and transparency. Indeed, long exposure to democracy has been observed to have a 'protective effect' (Venard 2019; Transparency International 2018). Conversely, corruption has a corrosive effect on democracy (Transparency International 2018). Ross et al. (2011) noted that "the aspirations of a new generation driven by relatively high rates of population growth, but limited jobs opportunities and the resource rents are likely to continue to condition the political economy trajectories of the region" (p. 12).

Likewise, Van der Ploeg (2010) analysed resource-rich developing economies that cannot successfully convert their resources revenue into productive assets. He found contributing factors such as less democratic systems, weak institutions, lack of the rule of law, corruption and underdeveloped financial systems, was dominated by grabbing institutions and civil conflict. All these factors can explain why these countries cannot benefit from the presence of natural resources since the resource revenues go through to unproductive activities causing economic growth to be adversely affected.

In contrast, the study by Battacharyya and Mamo (2020) found no evidence of oil and mineral discoveries causing conflicts in Africa. Their empirical research used a unique geographical dataset and they controlled for property rights, past discoveries and fixed effects for countries and years. Indeed their results indicate that natural resource discoveries reduce conflicts by improving political support and assistance which increases living standards.

While the above discussion of the 'resource curse' regarding rent-seeking, corruption, governance structure and political issues effects, and their effects on growth in resource-rich economies provides important context, addressing these aspects is not the focus of this study. Rather, the Dutch disease model is the most relevant 'resource curse' aspect in this study. The Dutch disease model is useful for examining the direct impact on economic growth and inflation through a set of macro-economic effects, emphasising effects that result in a loss of international competitiveness for the non-resource sector (Sachs & Warner 2001; Papyrakis & Gerlagh 2004; Larsen 2006; Lim & Bao 2007; Cox & Harvie 2010; Broz & Dubravčić 2011). In particular, emphasis is placed on the impact of Dutch disease in terms of a real exchange rate appreciation and its flow-on effects on the output and exports of the non-oil traded sector. Therefore, this study will focus solely on the economic aspects of resource production, operating through the Dutch disease effect based, and extending upon, more recent studies by Cox and Harvie (2010), Kuboniwa (2012), Hasanov (2013), Mohammadzadeh (2015) and Ali and Harvie (2017). Section 3.3 will detail the economic channels through which Dutch disease operates

3.3 The Dutch Disease

Dutch disease represents the economic channel of the resource curse in which dimensions of macro-economic and policy channels related to Dutch disease include the current account and exchange rate, government revenue and income effect, spending effect, and resource movement effects (Buiter & Purvis 1983; Cox & Harvie 2010; Kaznacheev 2013). The current account and exchange rate effect is caused by the massive inflow of foreign exchange due to higher resource exports during the resource boom period (resource production shocks or resource price shocks). This leads to increased demand for the domestic currency, resulting in an appreciation in nominal and real exchange rates. Increased resource exports lead to an accumulation of foreign asset stocks through an increased inflow of foreign exchange due to improved trade and current account balances under a fixed exchange rate (Ali 2011). The increase in resource revenue caused by the rise in resource exports generates an increase in permanent income (wealth) and spending (government revenue and income effect). Increased government revenues also encourage further government spending[24] that increases demand and thereby prices in both tradeable and not tradeable sectors (spending or wealth effect). These first four effects affect the demand side of the economy by influencing spending (Sachs & Warner 2001; Ali 2011; Mohammadzadeh 2015). However, the resource movement effect affects the supply side movement of labour and capital from the diminishing non-resource sector to the growing resource sector, in which wages and capital returns are relatively higher (Corden & Neary 1982; Corden 1984; Neary 1985; Neary & Wijnbergen 1986). These channels are related to Dutch disease.

[24] This is the critical mechanism in a developing country. In a developed country, most of this spending will take place through the private sector (which produces and effectively owns the resource).

3.3.1 Pure Dutch disease (exchange rate effect)

The discovery of a natural resource, such as minerals in Australia, gas in the Netherlands, oil in the UK, Norway and OPEC member countries (Corden & Neary 1982) and the increase in the production (boom) or prices of these natural resources have led to the emergence of the so-called Dutch disease effect. It is associated with windfall gains of foreign exchange in the domestic economy due to massive exports of natural resources (Harvie 2019) or capital inflows associated with FDI in the natural resources sector (Korhonen & Juurikkala 2009; Mohammadzadeh 2015). While the enormous increment in natural resource export revenues leads to increased national wealth and promises an improvement in overall general welfare (Rudd 1996), it also causes an exchange rate appreciation, which negatively affects the non-resources tradeable sector due to a loss of competitiveness in that sector's export market. Ultimately, there is a marked contraction of the non-resources tradeable sector (Hasanov 2013; Fakhri 2O13), such as manufacturing in developed countries and agriculture in developing nations. The changes in export competitiveness adversely affect the non-resource sector, particularly the tradeable sector. This leads to structural change in the export and production of non-resource sectors, such as manufacturing and agriculture, which lowers the relative contribution of non-resource tradeable GDP in total GDP. This is called the exchange rate and current account effects of Dutch disease ('pure Dutch disease'), and the now relatively lower-priced imports may supplant domestic production, leading to further deterioration of the contribution of non-oil output (Ezeala-Harrison 1993). Conversely, the non-treatable sector of non-oil output will increase, which could offset the decline in non-oil tradeable sectors.

The pure Dutch disease posits an appreciation of the real exchange rate, which leads to a loss of competitiveness of the non-resource tradeable sector, as the key symptom of this disease and the primary means of transmitting the effects of resource production to the domestic economy (Corden & Neary 1984; Wijnbergen 1984; Krugman 1987; Harvie 1993; Caballero & Lorenzoni 2009; Hasanov 2013). The concept was initially explained by *The Economist* (1977), in which the term was first coined, but the underlying mechanisms were more formally described by Gregory (1976) using

Australian agricultural sector data. Hence, the terms 'Gregory effect' or 'Gregory thesis' also became commonly used (Clements et al. 2008).

The Gregory effect assumes that an appreciation of the exchange rate due to a boom in natural resource commodities (primarily minerals in this instance) has an adverse impact on other sectors, such as agriculture, manufacturing and other traded goods (though mainly agriculture, as he focused on Australia, where agriculture exports were significant). Therefore, additional discoveries of natural resources commodities or a significant rise in global prices would prompt concerns about the likely further appreciation of the real exchange rate and its effect on the competitiveness of other traded goods sectors (non-resource sectors) (*The Economist* 1977 cited in Clements *et al.* 2008; Gregory 1976). Similarly, more recent literature—Buiter and Miller (1981), Buiter and Purvis (1983), Eastwood and Venables (1982) and Van Wijnbergen (1981)—discussed this issue as pure Dutch disease. They argued that an appreciation of the exchange rate would adversely affect the competitiveness of non-resource exports, as well as firms in import-competing sectors. A recurring theme for resource-exporting countries experiencing a commodity boom is the significant impact of exchange rate appreciation. As non-resource tradeable exports decrease and imports of non-resource tradeables increase, local production levels and employment rates can fall, resulting in lower GDP growth (Usui 1997; Ezeala-Harrison 1993; Hong 2009). This can lead to rising prices in some non-tradeable sectors, such as services and construction, triggering price rises in such sectors, thereby increasing prices in the domestic economy (Ali 2011). This is closely related to channels of the economic transmission process related to price shock in the natural resource sectors, namely the resource movement effect and spending effect (indirect de-industrialisation).

3.3.2 Resource movement effect and Dutch disease—direct de-industrialisation

The 'resource movement effect' can directly contribute to a decline in the non-resource tradeables' sector—'direct de-industrialisation'—while the 'spending effect' can indirectly contribute to diminished profitability and output. This outcome is a key characteristic of the Dutch disease effect and is stated as reflecting 'de-industrialisation'.

This describes a situation in which a booming sector (natural resources) causes a rise in the prices of non-tradeable commodities relative to those of tradeable commodities, leading to a reallocation of production and resources in favour of the natural resources sector. This hampers the growth of the non-resource tradeable commodities sector (Adeleke 2014). The original and key theoretical contribution in this field is that of Corden and Neary (1982). The resource movement effect (see Corden and Neary 1982) was initially known as the 'direct de-industrialisation effect' of a resources boom (Corden 1984; Corden & Neary 1982; Stijns 2002, 2005). The impact of the resource movement can only exist when the resource sector shares the inputs of production (domestic labour and capital) with other sectors. Corden and Neary (1982) explained the core Dutch disease model, in what is considered the first methodological framework to examine the structural impact of a resource boom sector in a resource-abundant economy and its impact on other sectors in the economy. Corden and Neary (1982, p. 825) note that Dutch disease is an economic term, referring to 'the coexistence within the traded goods sector of progressing or declining, or booming and lagging sub-sectors'.[25] They observed that their findings equally applied to the impacts of booming extractive industries (oil, gas and minerals) and situations in which older non-extractive industries were replaced by more technologically advanced activities. In both, the booming sector pressures the lagging sector by pulling resources (labour and capital) from the latter; it also causes a rise in the relative price of non-traded goods (see Corden & Neary 1982, p. 825, 827, 842).

However, Corden and Neary's (1982) model assumes a small open economy that includes three sectors: a booming sector (in this instance resources); a lagging sector (non-resource tradeable sector, such as manufacturing); and a non-tradeable sector (comprising activities such as services and construction). In these sectors, prices are determined in the domestic economy while prices in the booming and lagging sectors are exogenously determined by the international market. The output of these three sectors is produced by internationally immobile capital and labour, and only used for final consumption. Corden and Neary (1982) assume that there is specific capital for each sector (p. 842) while labour is perfectly mobile across the three sectors (p. 827). The

[25] Corden and Neary (1982) use the term 'subsector' (of the traded goods sector) for what this author prefers to call 'sectors of the economy'.

economy operates at full employment (on its production possibilities curve) and there are no idle or unemployed resources.

Also, the model assumes there are no commodity or factor market distortions in the economy and that the wage rate adjusts flexibly to ensure it is equalised across all three sectors and full employment is always maintained (Corden & Neary 1982, p. 841). Trade is always balanced, as national output is always equal to national expenditure (Corden & Neary 1982, p. 826). Booming sector output is wholly exported and lagging sector production is perfectly able for tradeable imports. Monetary considerations are disregarded and only relative prices (measured by lagging sector prices to non-tradeable prices) matter (Corden & Neary 1982, p. 826). The boom in the resource sector increases marginal production inputs and prices of these production inputs, such as labour (Neary & Wijnbergen 1986). Increased demand for labour in the booming sector leads to increased wages in the labour market generally to obtain equilibrium (demand and supply of labour) across the economy. The demand for labour and its cost increases in the manufacturing sector, in conjunction with an appreciation of the real exchange rate, makes it uncompetitive with imports and profits are squeezed. Exports, production and employment in the manufacturing sector decline. Rising wages influence both the lagging and non-tradeable sectors, and this places downward pressure on profits in both sectors. The non-tradeables sector, however, will likely observe a rise in prices to offset this. Increased resource-based exports, such as oil, will require a shift of production factors (labour and capital) to this booming sector, and other non-resource tradeable goods sectors will be worst affected, as they lose resources (Corden 1984).

In resource-abundant economies, most tradeable production is located within the natural resources sector, but labour is concentrated in the non-traded sector. Hence, in a resource boom, the manufacturing sector tends to be further squeezed, while the non-traded sector (e.g., services) expands. Increased revenues lead to greater demand for non-traded goods, which increase in price. As non-traded goods are used as manufacturing inputs, their higher prices combine with internationally fixed prices, lowering manufacturing sector profits. A consequent decline in manufacturing undermines economic growth. Moreover, Sachs and Warner discerned a correlation between resource abundance and higher price levels in non-tradeable sectors. They concluded that resource-abundant countries have higher price levels. With expensive domestic inputs, and output selling on international markets, manufacturing loses its competitiveness. Manufacturing then fails to develop, while non-tradeable sectors continue to expand (Sachs & Warner1997a, p. 6 &23). Finally, natural resource-abundant countries often fail to pursue export-led growth because of the lack of export competitiveness and promotion.

Harvie (2019) claimed that when the resource sector is more capital intensive than other sectors, as is commonly the situation, it will generally attract more capital than labour, and the return on capital will increase with respect to that on labour. If the lagging sector is comparatively more capital intensive than the non-tradeable sector, this has a somewhat greater effect on the lagging sector such as increasing costs, falling benefits and expanding capital outflow, leading to further reductions in non-resource-tradeable sector production.

However, if the resource movement effect is not important, the spending effect comes into play as the most important explanation of de-industrialisation. As explained in Chapter 2, in the case of Libya, capital requirements were most likely met by international capital inflows since domestic saving was inadequate to meet the needs of expanding oil production, and labour would most likely be in the form of skilled labour from overseas. On this basis, the impact on domestic capital and labour markets would be small. Therefore, direct de-industrialisation effects are unlikely to be strong and greater emphasis should be given to spending or indirect de-industrialisation effects. Hence, this study suggests that among the Dutch disease models that can be adapted, the Cox and Harvie (2010) model (see Chapter 4) is the most convenient approach for Libya, it focuses on spending or indirect de-industrialisation effects more than it does the resource movement effect. The best characterisation of the Libyan oil sector is that of high economic rent with limited resource movement effects. Hence, the spending effects are most relevant (see Chapter 4). As the spending effect is more relevant to Libya than the resource movement effect, the following explanation considers the spending aspect of Dutch disease in greater detail.

3.3.3 Spending effect of Dutch disease—indirect de-industrialisation.

In developing countries with limited capital and limited skilled labour (such as Libya), these resources may need to be imported to limit the impact on domestic capital and labour. The resource movement effect is less, and the spending effect can have more impact.

The spending effect is emphasised in the literature by Bruno (1982), Wijnbergen (1981) and Buiter and Purvis (1983). In this case, the economic rent from resource production is dominant and the resource movement effect is minimal. In this interpretation—in which resource production does not require a considerable transfer of resources (labour and capital) from the non-resource sectors, skilled labour and capital requirements can be obtained from overseas or the economic rent from oil production significantly dwarfs resource requirements (Andrade 2017)—the resource movement effect will be of lesser importance in the process of de-industrialisation. If the income (economic rent) generated by the booming resource sector is large, the spending effect is more important. Mohammadzadeh (2015) argued that Dutch disease is more generally connected with the expenditure effects arising from higher resource revenue. He asserted, however, that the significance of this impact is based on the characteristics of the country's resource sector. If economic rents from resource production are high and extraction costs are low relative to revenues, the spending effect is likely to be significant. If extraction costs are high relative to revenues generated by the resource, economic rents will be low and the spending effect will not be so critical.

Corden (1985) argued that the 'spending impact' establishes a scenario in which a boom in the natural resource sector with higher economic rent, perhaps caused by an increase in world prices for the commodity, prompts expanded income, subsequently increasing demand for both tradeable and non-tradeable goods. Since the price of tradeable products is exogenously determined in world markets, it will not change. However, the higher demand for non-tradeable products will result in a rise in the relative price of non-tradeable goods, which is equivalent to a real exchange rate appreciation (Corden 1985). This invariably leads to increased inflation due to rising prices in the non-tradeable sector. Higher prices in the non-tradeable sector could encourage investment in this sector, but can hurt the output of the tradeable sector, excluding resource sector industries such as oil (Neary & Wijnbergen 1986). Any further spending increases the relative price of non-tradeable sector output and is consistent with a further appreciation of the real exchange rate (Rudd 1996). An appreciation of the real exchange rate will negatively influence the trade account (balance of trade). Increased expenditure and demand for tradeables also leads to increased imports of tradeable goods, which become relatively cheaper than domestic goods (Romer 1983). These changes can lead to adverse effects, such as a deterioration in the balance of trade (when the value of a country's exports decreases relative to its imports) and a fall in output of the non-resource tradeable sector (manufacturing); thus, lower non-oil GDP growth and higher inflation can be anticipated.

Similarly, Harvie (2019) affirms that in a resource boom, the direct impact of resource movement primarily affects the supply side in the economy. He further notes that the spending effect, regardless of whether it is from the private or public sectors, operates indirectly through increased demand for both non-resource tradeable and non-tradeable output. The price of the tradeable sector output will not change since it is determined in international markets, and higher imports will meet this expanded demand. The price of non-tradeable output is determined in the domestic economy, so with further demand, the relative price of non-tradeables to tradeables will increase. This is equivalent to a real exchange rate appreciation that results in a loss of competitiveness of the lagging sector, increased demand for non-resource tradeable imports, reduced non-resource tradeable exports and an overall deterioration in the non-resource tradeables balance. Any additional demand after this will require extra supply, as labour is drawn into the non-tradeable sector by rising wages.

Nonetheless, increased government spending on private construction and public services (consumption, wages and social welfare expenditure) increases demand for tradeable and non-tradeable goods (Stijns 2002) and encourages product imports because they become cheaper relative to the domestic equivalent with an appreciation of the real exchange rate (Ali 2011). According to Stijns (2002, 2005), the price of imported commodities falls relative to the price of local commodities as a result of real exchange rate appreciation. As a consequence of these spending effects, the supply of non-oil output, which depends on the relative impact on the non-oil tradeable and non-oil non-tradeable sectors, can decline overall, leading to lower economic growth and higher domestic prices (Stijns 2002, 2005). Nevertheless, growth in non-oil output may be moderated when the non-tradeable sector growth offsets the decline in non-oil tradeable output, at least in the short term. However, this will depend on country characteristics.

Conversely, some authors (e.g., Schoar 2002; Ali & Harvie 2013, 2017) argued that the impact of government expenditure on the economy arising from the spending effect is dependent on their propensity to use oil revenue for consumption or development purposes. Increased expenditure on development projects and programs aimed at enhancing the supply of non-oil output and expenditure targeting economic growth through productivity-enhancing expenditure have the potential to produce higher rates of growth than expenditure that boosts domestic consumption demand. Spending on the development side aims to boost productivity and economic growth through expenditure on productivity-increasing factors, such as education, health and infrastructure (but also imported technology and equipment). It can be aimed at improving the competitiveness of the most afflicted sector. Development expenditure on public construction (i.e., public infrastructure investments, such as roads, ports and railway projects) can boost productivity on the supply side, which can positively affect real GDP growth in the short and long term (Dissou & Didic 2011). Such improved productivity can offset the loss of competitiveness from the stronger exchange rate and higher labour cost. As labour flows to the non-tradeable sector because of higher wages, this increases wages in the manufacturing sector and could adversely affect profitability and output later.

This could also be expressed through the issue of stimulating domestic savings relative to consumption. Van der Ploeg (2011), Van der Ploeg and Venables (2012) explained that increasing public savings is advisable to ensure that the non-traded sector produces enough 'homegrown' capital to support infrastructure development and consumption.

Under such a scenario, the exchange rate appreciation is reversed because of the growth in domestic capital.[26]

[26] Increased public savings replace foreign capital inflows but this is unlikely. This is an important issue. Savings generated by the public sector should be invested domestically (in the form of a futures fund) or invested overseas in

Increased domestic savings reduce the demand for international capital and minimise upward pressure on the exchange rate. Increased domestic savings (running fiscal surpluses) leave more capital for domestic investment. Running fiscal surpluses,[27] as suggested by Corden (2012), would emphasise the role of the private sector in this process. When the private sector is sufficiently strong to initiate the investment in an efficient manner, the private sector may bring greater investment efficiency (this will be empirically investigated in Chapter 6).

To conclude, more recent models of Dutch disease (Cox & Harvie 2010; Ali 2011; Mohammadzadeh 2015) related to the spending effect suggest that the boom in the natural resource sector coupled with potential shocks in world resource prices affect the economy through five channels, assuming economic rent from resource production is high. First, there is an income effect in which resource production adds straightforwardly to the real income of the country. Second, there is a revenue effect (in which a government's abilities are augmented through additional revenue generated from resource production). This case is most relevant in the context of developing countries, such as Libya, where the resource sector is predominantly state-owned, or taxation revenue from resource production is considerable (Ali 2011). Third, a spending impact can occur for different reasons, including private sector spending because of extended present and future salaries, changes in the stock and worth of real and financial asset holdings, and public sector spending due to expanding tax revenue capacity. Fourth, there is a current account effect, in which resource production increases exports. This augments the trade balance and current account. Finally, there is an exchange rate effect in which resource exports generate massive foreign currency inflows that strengthen the value of the nominal real domestic currency (see Cox & Harvie 2010; Ali 2011; Mohammadzadeh 2015).

Section 3.4 will show empirical evidence on the existence of Dutch disease and macro-economic policy responses in the context of the exchange rate effect and spending

the form of a SWF. The stage of development is important here. For a poor developing economy, it would be difficult to not invest domestically to improve the population's social and economic wellbeing. For a developed economy such as Norway, public savings could more easily be invested abroad. This would depreciate the exchange rate and improve the competitive position of the non-resource tradeable sector.

[27] See Section 3.4.2 for more detail.

effect of Dutch disease, this being more relevant to Libya than the resource movement effect.

3.4 Empirical Evidence and Identifying the Research Gap

There is little confidence in most developing countries about the possibility of utilizing natural resource revenue to enhance their economic performance. This is because of the realization of the difficulties in making good decisions to use resource earnings successfully to achieve complex economic and political goals. This requires appropriate private investment, effective fiscal regimes and policies to manage volatility and alleviate adverse influences from resource shocks on the rest of the domestic economy (Venables 2016). This section will review the strategies that explain how macro-economic policy responses can possibly mitigate the adverse impacts of natural resource revenue, due to an oil price shock, on the domestic economy.

This section is divided into two parts. The first reviews the literature on the impact of Dutch disease on non-oil GDP growth and inflation, and macro-economic policies aimed at mitigating the impact of Dutch disease, focused on oil-producing and exporting developing countries. The second section shows how this can fill the empirical research gap.

3.4.1 Dutch disease and macro-economic policy responses—existing strategies

This section reviews the literature on existing strategies to alleviate Dutch disease. Section 3.4.1.1 will explain the relationship between Dutch disease and exchange rate policy.

3.4.1.1 Dutch disease and exchange rate regimes policy—a review

While there are few empirical studies that investigate Dutch disease in the MENA countries under different exchange rate regimes, this section attempts to review recent studies that have done so. It will focus on studies that emphasise the exchange rate effect of the Dutch disease and provide a macro-economic policy response to mitigate it.

To date, the empirical literature shows that some developed and developing country oil producers and exporters remain subject to Dutch disease effects. Valeriy et al. (2015) showed that developed oil-exporting countries such as Russia still suffer from this issue. Their study discovered signs of Dutch disease effects in the Russian economy. They further developed the classical theoretical model of Corden and Neary (1982) to examine three consequences of Dutch disease—the spending effect, the resource movement effect and the exchange rate effect—to investigate which channel of the Dutch disease was more relevant to the Russian economy during 2002–2013. The results revealed two indicators of the Dutch disease effect in Russia. The first was the appreciation of the real exchange rate due to increased natural resource exports. While this was not unexpected, a decline in the manufacturing sector growth rate was observed. The manufacturing sector's growth rate can decline. As long as its growth remains positive, total production will still increase (in absolute terms). However, its relative contribution to GDP will decline as long as the growth rate of services and oil are positive and higher than that of manufacturing.

The second sign, considered less important than the exchange rate effect, was the movement of labour and capital from manufacturing to sectors with relatively higher wages, such as the natural resources and services sectors. In this regard, the services sector tends to be more labour intensive, while the oil sector (and resource sector generally) is capital intensive and so does not generate many additional jobs. As the required skill sets do not usually exist in the local population, many jobs within the sector are often filled by imported labour, at least initially. As a consequence, more employment needs to be generated in the services sector than in the manufacturing sector, as the latter is frequently affected by decreasing international competitiveness and falling demand. Rising demand for labour in the services sector, due to increased demand for non-tradeables can lead to a drop in relative output value, lower growth of the manufacturing sector (tradeable sector) and an increase in services sector prices (non-tradeables) over the long term (Valeriy et al. 2015). The study concluded that a real exchange rate appreciation has significant impacts on non-oil output and manufactured output in particular.

A counter study to the Dutch disease conducted by Bahar and Santos (2018) found that countries with large exports of natural resources have high levels of concentration in non-resource exports, especially for developing countries. This concentration is characterised by larger volumes of existing non-resource exports rather than increased varieties of new products. The share of capital-intensive exports also increases giving further evidence to counter the arguments of falling exports in the non-resource tradeable sector following resource discoveries.

Adeleke (2014) investigated the relationship between oil price shocks and manufacturing sector output under different exchange rate regimes in African oil-exporting countries (AOECs). These included Nigeria and Algeria, with flexible exchange rates, and Libya and Gabon with fixed nominal exchange rates, during 1970–2010. The study used a panel SVAR model focused on oil price shocks and their impact on the interest rate, money supply, inflation rate, exchange rate and manufacturing output. The study discovered that oil price shocks led to currency appreciation in all countries examined, but was more conspicuous in Nigeria, Algeria, Gabon and Libya. In these countries, oil price shocks led to an exchange rate appreciation, negatively affecting manufacturing output. However, the degree of impact on output varied. The impact was more significant in countries with a fixed exchange rate (such as Gabon and Libya) than it was in those with a flexible exchange rate (Nigeria and Algeria). This was confirmed by both the IRF and variance decomposition (VD) analyses of a SVAR model. The impulse responses for countries with a fixed exchange rate showed that a positive oil price shock led to a large decline in manufacturing output and increased money supply and inflation for prolonged periods. They also showed that the manufacturing sectors in these countries were highly susceptible to oil price shocks compared to those of countries with a flexible exchange rate.

An analysis showed that manufacturing output made a higher contribution, as a percentage, to inflation than other macro-economic variables. This implies that inflation in Libya and Gabon is higher than it is in countries with a flexible exchange rate since inflation is most likely a structural phenomenon influenced by non-oil output sectors (e.g., manufacturing in Adeleke [2014]) rather than a monetary issue with the fixed exchange rate. The nature of inflation observed in these countries appears to be more structural than monetary. This is consistent with the findings of studies on other developing countries (see Mordi & Adebiyi 2009; Ushie et al. 2012). The type of inflation that occurs is because of imbalances between output and prices (the gap between demand and supply in the economy), or imported inflation, but not because of increased money supply or lower interest rates (ADB 2010; IMF 2012, cited in Adeleke 2014). This may be partly attributable to the lack of an appropriate monetary policy to stimulate growth in the manufacturing sector in AOECs, including Libya and Gabon.

A limitation of Adeleke (2014) study is its exclusion of the role of government spending in the domestic economy. In developing, oil-exporting countries under an oil price shock, the impact of fiscal policy cannot be isolated from monetary policy, through which government spending can enhance growth in the non-oil output sector and monetary policy can control inflation (IMF 2008, 2016). This observation prompted the current study to investigate to what extent a combination of fiscal and monetary policy can mitigate the adverse impact of positive oil price shocks on the domestic economy in terms of real non-oil GDP (growth) and prices (inflation) (see Chapter 7).

Bahmani-Oskooee and Kandil (2007) produced different findings to those of Adeleke (2014). They used the VAR method and cointegration to test the impact of nominal effective exchange rate appreciation due to oil price shock on macro-economic variables such as non-oil output and inflation in Iran during 1959–2003 in the short and long term. The study found that under a flexible exchange rate, nominal exchange rate appreciation had a significant negative impact on non-oil output and its growth in the short term. Currency appreciation reduced over time. The authors had predicted this result since currency appreciation tends to be expansionary in the short term and contractionary in the long term. Notwithstanding the varying effects of exchange rate fluctuations on the demand and supply sides of the economy, managing a flexible exchange rate gradually over time can achieve stability in the real effective exchange rate. This study suggests that in countries such as Iran, a well-managed exchange rate that achieves economic stability can enhance economic growth.

Conversely, Ali and Harvie (2015a) used the autoregressive distributed lag (ARDL) method to develop a macro-economic equilibrium model for the Libyan economy using data from 1970–2007. They concluded that a flexible exchange rate would likely benefit investment in the Libyan private sector more than a fixed nominal exchange rate policy would. According to the authors, a flexible nominal exchange would increase domestic production in the real sector of the economy through the accumulation of human and physical capital stock and the importation of technology.

Ali and Harvie (2015a) concluded that moving from a fixed exchange rate regime to a flexible exchange rate regime reduces the effects of Dutch disease in the short run and enhances supply and demand for non-oil output. To achieve this result, the adjustment related to the movement from a fixed to flexible nominal exchange rate regime should be subject to perfect capital mobility rather than imperfect capital mobility. The competitiveness of non-oil exports recovers faster with a flexible nominal exchange rate regime after a slight appreciation in the real exchange rate in the early stage of the adjustment due to the oil shocks. With a flexible nominal exchange rate regime, the path of exchange rate adjustment depreciates and returns rapidly to its baseline value result in an increase in non-oil output. Therefore, it can be claimed that Dutch disease effects can be mitigated by moving from a fixed to flexible exchange rate regime combined with perfect capital mobility.

A flexible nominal exchange rate policy results in a number of advantages for the domestic economy, according to Ali and Harvie (2015). This includes an improvement in non-oil production arising from an accumulation of public physical capital stock, human capital stock, imported capital stock and private capital stock, which enhances the supply side. It also improves the competitiveness of non-oil exports in the international market, which is associated with a depreciation in the early short run due to changing from a fixed to flexible exchange rate regime. This encourages higher investment by the private sector and increased private sector capital stock. The growth of the non-oil sector is influenced positively by boosting the accumulation of imported physical capital stock; the benefits of this will be further enhanced when this capital stock is embedded with higher technology and when there is a liberalisation of capital flows policy combined with a more flexible nominal exchange rate (see Ali & Harvie 2015).

In line with Adeleke (2014), Omolade and Ngalawa (2017) used a SVAR approach to examine the link between four key factors—the nominal exchange rate, manufacturing output growth, inflation rate and the growth in world oil prices—under different exchange rate regimes, fixed and flexible, using data from 1980–2012. The study was set in two oil-exporting countries, Libya and Nigeria. Libya employed a fixed exchange rate regime while Nigeria used a flexible exchange rate. The results showed that any oil price shock that produces upward pressure on the exchange rate tended to squeeze out the tradeable sector, hurting the growth of the manufacturing sector. The authors argued that a flexible exchange rate creates an enabling environment for monetary policy instruments to influence manufacturing output growth positively in the face of an adverse impact on manufacturing output growth (caused by oil price shocks and exchange rate appreciation). A flexible exchange rate provides a better atmosphere for promoting manufacturing output growth. However, an IRF analysis showed that the growth in manufacturing output under a flexible exchange rate is slightly more significant than growth under a fixed exchange rate (Omolade & Ngalawa 2017). IRF analysis indicates that inflation in Nigeria under its flexible exchange rate does not follow the path of manufacturing output. Thus, inflation is likely to be more monetary than it is structural.

This study only considers the manufacturing sector, which is small in both countries, and ignores agriculture, which is arguably more important. For this reason, the current study focuses on real non-oil GDP instead of manufacturing output in the model of Chapter 4 and empirical analysis in Chapters 5, 6 and 7. Real non-oil GDP can be a more realistic measure of the adverse impact of Dutch disease across the total of non-oil output. This is because developing countries are likely to experience the largest decline in the agriculture sector, as their manufacturing sectors remain small.

Omolade and Ngalawa's (2017) findings differ from those of Adeleke (2014), who also used IRF analysis. Given these conflicting results, there is no generalisation as to which exchange rate regime can provide better outcomes. The main recommendation from Omolade and Ngalawa (2017) for future research is to determine which exchange rate regime can best isolate the domestic economy from external shock, such as oil price shock, and which instruments of monetary policy can effectively maintain internal economic stability. This is a research gap, which the current thesis will attempt to explore and fill (see Chapters 6 and 7).

From the varying results of the few studies on Dutch disease and the exchange rate regime in MENA countries, it is clear that there is no agreement on the choice of the most suitable exchange rate to maintain macro-economic stability. According to Jakob (2016), in practice, the choice of an appropriate exchange rate system is likely to be based on the economic features of each country and the type of shock considered, as well as the degree of independence between a government's macro-economic policies. This would be consistent with the theoretical concept that shows the difference between a fixed exchange rate regime, considered a good recipe for maintaining economic stability (see McKinnon 1963; Kenen 1969; Helpman & Razin 1982; Yeyati et al. 2010; Tan 2002), and a flexible exchange rate, which provides an independent impetus for monetary policy as a useful economic mechanism (see Friedman 1953; Kaminsky & Reinhart 2000; Rusydi 2006; Al-Raisi et al. 2007; Nguyen 2014). Section 6.4.1.2 will explain Dutch disease and fiscal policy response.

3.4.1.2 Dutch disease and fiscal policy response—identifying the research gap

Public expenditure has been a central focus of many studies that have sought explanations for variations in economic performance in and across different country contexts, including oil and non-oil producing countries. Wu et al. (2010) compared the impact of public expenditure on economic growth between developed and developing countries using a large sample across 182 countries and data from 1950–2004. The study employed a panel Granger causality analysis to demonstrate the link between government expenditure (consumption and investment) and economic growth. In the

group of developed countries, which were disaggregated based on income level and corruption rate, the results showed a causal positive link between government expenditure and economic growth rates. Wu et al. (2010) argued that supply-side expenditure that focused on enhancing infrastructure had the most substantial positive effect on economic growth. Hence, in low-income developing countries, the results indicated that the causal link between government expenditure and economic growth was not significant. These countries suffered from low economic growth, despite higher government expenditure. However, the goal of government spending in respective contexts, developed and developing, is noteworthy. Public spending in the developing country context was likely to have focused on consumption rather than investment in 1950–2004, and involved rent-seeking behaviour (Wu et al. 2010).

Likewise, Villafuerte and Lopez-Murphy (2010) used a large sample of oil-producing countries across the world to explore the relationship between oil revenue and budget deficit. The study included Algeria, Angola, Azerbaijan, Bahrain, Bolivia, Brunei, Cameroon, Chad, Congo, Ecuador, Equatorial Guinea, Gabon, Indonesia, Iran, Kazakhstan, Kuwait, Libya, Mexico, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, Sudan, Timor-Leste, Trinidad and Tobago, UAE, Venezuela, Vietnam and Yemen. Using VAR, IRF methods and a Granger causality test, five critical findings were made. First, oil revenue represents the primary resource of fiscal revenue for most oil-producing countries in the sample. Second, IRF revealed that increased government expenditure leads to a significant positive reaction in domestic demand for consumption. Thus, the idea that most government spending in these countries is on current consumption spending is supported by the empirical evidence. There was evidence of causality between government spending and domestic prices, but no causality between government spending and growth in the country. Thus, the study concluded that government expenditure leads to increased domestic prices, but has no significant impact on non-oil GDP growth.

Third, IRF analysis revealed, both in absolute and relative terms, that a negative shock in non-oil GDP (decrease) and its growth leads to a significant increase in budget deficits. This can be attributed to lower taxing of non-oil revenue, particularly in Iran, Kuwait, Libya, Oman, Qatar, Saudi Arabia, Sudan and Yemen. Fourth, fiscal deficits can strongly influence inflation through increased money supply since financial markets are imperfect in these economies. Further, they cannot sell government bonds to raise funds and must borrow from their central banks (which is equivalent to increasing money supply). Finally, in MENA oil-exporting nations, increased government spending, due to an increase in resource revenue, generates more demand, especially for consumption, leading to a rise in domestic prices. There is no improvement on the supply side to improve non-oil sector output. Landau (1983, 1986) and Akinlo (2006), who investigated the impact of government spending on economic growth in African and MENA developing oil-producing countries, reached a similar conclusion using a Granger causality test.

Similarly, in regard to oil-producing countries exporting massive quantities of oil, Hasanov (2013) identified a significant negative impact of government spending on economic growth in terms of the spending effect. Hasanov (2013) tested the main channels related to Dutch disease that could be used to explain lower economic growth in the Azerbaijani economy. To this end, Hasanov investigated two effects related to Dutch disease—the spending and resource movement effects—to discover which had a more significant impact on the growth of non-oil GDP. The study used a set of macro-economic variables, which included oil GDP, non-oil GDP, government expenditure, employment rate, growth of nominal wages and the real exchange rate over 2000–2007. The author applied the VAR method and cointegration analysis. While the cointegration and error correction model indicated that the real oil price resulted in a significant appreciation of the real exchange rate in Azerbaijan, the study confirmed that there was no significant resource movement effect on the economy with oil production more capital than labour intensive. The findings showed unchanged or slightly reduced employment in the oil sector during the period of the study. Government expenditure, mainly influenced by oil revenues, generated a 'spending effect' in the non-tradeable sector, leading to lower non-oil tradeable sector GDP growth. Due to declining productivity growth in the non-oil tradeable sector, there was no stronger alternative explanations for Dutch disease that accounted for the declining growth in this sector or the observed high price of the non-tradeable. Therefore, there was no explanation for Azerbaijan's real exchange rate appreciation. However, the resource movement effect appears to have no significant impact; rather, it is the spending effect from Dutch disease that better explains low non-oil sector productivity growth and higher real wage rates (Hasanov 2013).

Many studies on developing oil-exporting countries (including MENA) have paralleled the findings of Hasanov (2013), but they enhanced these results through distinctions made between government consumption and investment spending. Ali and Harvie (2017), Berument and Ceylan (2010), Ali (2011), Lee and Sh. Ni (2002), Issa et al. (2008) and Basnet et al. (2015) reported similar conclusions and claimed that the significant adverse impact of Dutch disease is due to the real exchange rate appreciation associated with oil production and oil prices shocks on the growth of real non-oil GDP. They further asserted that the impact was exacerbated by the spending effect, especially the spending effect due to government consumption spending, which leads to rising domestic prices.

For example, Ali (2011) explained that higher levels of government expenditure can aggravate the impact of the spending effect when government expenditure enhances demand more than it does supply in the domestic economy, leading to higher domestic prices. Ali (2011) employed an ARDL method to examine the impact of Dutch disease associated with oil-related shocks on the Libyan economy under a fixed exchange rate during 1970–2007. He found that increased oil exports due to positive oil-related shocks, positive oil production and oil price shocks decrease competitiveness due to currency appreciation. This leads to a decline in real non-oil output and lower economic growth. This finding indicates that lower non-oil output due to a real exchange rate appreciation effect associated with higher domestic demand for consumption (due to spending effect) leads to rising domestic prices. The country ignored the development of non-oil sectors. Thus, considerable government spending focused on consumption, which did not improve supply and generated higher demand in consumption, leading to price rises. This can also cause trade balance deterioration and lower economic growth (Ali 2011) because there is greater spending on imported consumer goods, which are a part of the current account. This can negatively affect the non-oil trade balance and hinder the accumulation of physical capital and human capital where resource abundance may reduce incentives to use accumulated skills and human resources. The latter is exemplified by failures in education and health. Fiscal policy may be the key determining factor of money supply and increasing inflation in developing countries such as Libya, which runs fiscal budget deficits. This is assuming that monetary accommodation is the main source of financing this deficit. In this sense, money supply can continue to increase, leading to sustained higher inflation. This is in line with the theoretical concept of several economic scholars (see Usui 1997; Roemer, 1983; Connolly & Taylor 1976).

Mohammadzadeh (2015) used a more recently developed dynamic stochastic general equilibrium (DSGE) method to investigate the impact of oil production and its related shocks (oil production and price) on a developed country, Australia. A focus on the fiscal policy response revealed similar results, even when using the DSGE method. The IRF of DSGE applied for government expenditure also provided significant results during a resource boom to improve the output of non-resource sector. This is if the government allocates more of the collected funds from the resource sector to be allocated to infrastructure investment and human capital, rather than consumption expenditure. This study recommended that the economy benefits from shifting government consumption expenditure (demand focus) to higher levels of investment expenditure (demand and supply).

Ali (2011) employed an ARDL method to investigate the impact of oil production and its related shocks (oil production and oil price) on the Libyan economy, with a focus on fiscal policy response. Similar results were recorded, even when using a different methodology and economy. The results from this study revealed that the government's allocation of oil revenue has a significant impact on Libya's economic growth. Government spending on consumption has a negative impact on the GDP of the non-oil sector and causes a rise in domestic prices. Government capital/investment expenditure, however, boosts both demand and supply and has a positive impact on GDP. Conversely, although government current spending focuses on demand, this focus is not on long-term projects that are encapsulated by the supply side. Imperatives such as the enhancement of productivity, health, education and infrastructure are neglected; hence, demand for tradeable and non-tradeable goods typically increases. The increased demand for non-tradeable goods results in a deterioration in the output of non-resource tradeable goods. This simultaneously leads to lower GDP growth of the non-oil tradeable sector and increasing GDP growth of the non-tradeable sector. This trend provides strong evidence for the existence of Dutch disease, to which the Libyan economy is susceptible. The appreciation of the real exchange rate is a key indicator of Dutch disease in the Libyan economy.

Aregbeyen and Kolawole (2015) examined the relationships between oil revenue, government spending and economic growth in the oil-producing country of Nigeria, using fiscal policy indicators, including government spending, taxation, GDP and oil revenue, as critical variables. Using a vector error correction model (VECM), cointegration techniques, a Granger causality test and data from 1980–2012, the results revealed that oil revenue causes government spending, while there is no causality between government spending and economic growth. Nigeria is mainly dependent on the oil sector to finance GDP. This is risky, particularly when this source is affected by price volatility. High oil prices could result in instability in macro-economic factors, such as inflation and economic growth. This result aligns with that of Edwik (2007), who used the ordinary least squares (OLS) method and Libyan data from 1970–2004 to investigate an oil price shock and reliance of oil revenue on economic growth. This made Libya perform poorly in terms of GDP growth (Al- Jabiri 2012; Fargani 2013).

Edwik (2007) found that reliance on oil revenue to support public finances was the main reason for Libya's unstable and low economic growth. Libya relies heavily on oil receipts, the price of which tends to fluctuate widely in the international market. It either deteriorates when the future oil price declines (Fargani 2013), or remains steady if OPEC does not increase production; it may even rise depending on relative demand and production. Edwik (2007) concluded that although higher oil revenue provides funding for growth, it did not necessarily stimulate sustainable growth in the non-oil sector. The study noted that GDP growth might reflect inadequate private investment, and that low capital import growth is a precondition for faster economic growth. Similarly, investment effort and strong productivity growth are prerequisites for competitiveness and diversification in non-oil sectors. This indicates that the country has not focused adequately on government expenditure on investment that can offset the adverse impact of Dutch disease. Further, the government has spent more on investment, but rent-seeking behaviour has directed funds into unproductive and politically driven projects with little economic benefit.

However, the benefits of oil endowments can be obtained using the increased revenue to improve developments on the supply side. These developments include improvements in productivity through investment in infrastructure, education and health, requiring the use of domestic factors rather than relying on imported consumer goods and technology from the West (Edwik 2007). However, Edwik's (2007) study did not clearly explain why Libya's performance is worse—in terms of real non-oil GDP growth and inflation—than other MENA countries. It can be argued that the government sought an improvement in the lives of the population to maintain its popularity and legitimacy. This would involve greater consumption of (imported) consumer goods. This seems to have happened during the 1990s in Libya, as noted in Chapter 2.

Alimohamed (2014) used Libyan data from 1975–2010 and concluded that Dutch disease-related real exchange rate appreciation contributed to lower real non-oil GDP and lower economic growth in the country. Additionally, the spending effect on consumption and lower spending on public investment resulted in less economic diversification and lower non-oil output. The country's reliance on oil revenue makes the Libyan economy vulnerable to shocks in terms of fiscal balance and economic stability. Alimohamed (2014) recommend using oil revenue to improve the non-oil sector through an emphasis on government spending on investment in supply and economic growth. For this reason, Alimohamed (2014) suggests that development in non-oil sectors, such as agriculture and manufacturing, should be considered important, since these sectors can enhance growth in real output and diversify the economy. Therefore, it is suggested that governments in some oil-producing MENA countries, and other developing countries such as those in Africa, should increase spending on capital projects and intensify efforts to improve output and its growth in the non-oil sub-sector to boost economic growth.

The previous literature concluded that to reduce Dutch disease consequences of the spending effect, oil-rich countries should focus on investment spending. Edweib, et al. (2013) argue that the consumption behaviour of the public in Libya forces the government to spend more. Thus, Libya is an economy of consumers using oil revenue without a corresponding real increase in production. Further, its economy requires increased imports without a corresponding increase in exports from non-oil sectors.

Nevertheless, there is unlikely to be enough viable investment projects to use all oil revenue domestically, particularly in a developing economy that suffers from corruption. Government and institutional competency and corruption are related to the resource curse. A lack of corruption and institutional competence are needed to ensure that resources are allocated productively (even if this is overseas). The government needs to ensure that the best investment projects obtain financing, rather than it being preferentially allocated by government elites. The competence of domestic banks can help achieve this.

If higher returns can be earned by investing the funds overseas, it makes sense to do this, as it will generate a higher future income for the nation (e.g., Norway [Mohammadzadeh 2015]). This would guarantee continuous economic growth and benefit future generations by accumulating more productive assets. Resources, as a non-renewable depreciating asset, must be replaced by other income-generating assets, such as domestic and international financial assets. The idea behind investing resource revenue instead of paying for consumption expenditure is to increase productivity by increasing human capital (quantity and quality) and infrastructure facilities to generate sustainable future benefits. Increased productivity and production would improve economic growth by increasing actual GDP and potential GDP in the long term (Mohammadzadeh 2015), particularly when the government targets expenditure in investments that ease boom-induced economic capacity pressures (Bhattacharyya & Williamson 2011). Hence, the outcome depends on the benefits accruable, and whether funds are invested domestically or overseas. However, for a developing economy with low per capita income and poor social indicators, the government may face strong pressure to invest domestically, not overseas.

From another perspective, lower non-oil GDP and higher domestic prices cannot only exist because of ineffective government spending; ineffective monetary policy also has a role in this regard. The *IMF Country Report* (Lahreche et al. 2014), using data from 1988–2013, investigated sources of higher inflation in a MENA oil-exporting country, Algeria. The authors argue that under an ineffective monetary policy and interest rate, increased government expenditure leads to higher inflation more than it does economic growth. Ineffective monetary policy stimulates demand, but not supply, which leads to a rise in domestic prices with no significant response in terms of monetary policy. This in line with Cevik and Teksoz (2014) and Caceres et al. (2015), who report that in MENA countries, ineffective strategies are related to monetary policy, such as fixed or managed exchange rates. Ineffective responses of the interest rate result in higher domestic prices. This is because historically, monetary policy performance was weak in stimulating general economic activity, specifically in regards to boosting investment.

Monetary policy tools, such as interest rates, were not aligned with economic conditions. These tools were not deployed with any flexibility and interest rates were not directly responsive (IMF 2008; Ali 2011; Alimohamed 2014). Hence, despite large revenues and higher government spending in MENA countries, economic growth remained low for a long time (GDP growth did not exceed 6% during 1980–2016) (IMF 2016). The IMF (2003, 2008) argued that incorporation of and coherence among macro-economic policies—fiscal, monetary and exchange rate—could provide better macro-economic outcomes in terms of real GDP growth and inflation in Libya (Khan & Mezran 2013; Alimohamed 2014; IMF 2008; African Development Bank 2017). Therefore, the current study considers that combining government spending with effective monetary policy can mitigate Dutch disease. This will be examined in Chapters 6 and 7, under both a managed and flexible exchange rate regime, to discern the best macro-economic policies to achieve higher real non-oil GDP (growth) and lower domestic prices (lower inflation) under oil price shocks.

3.4.1.3 Identifying the research gap

The empirical literature on macro-economic policy responses to Dutch disease can be categorised into two groups. The first group reviewed Dutch disease and *exchange rate regime* policy; the second group explored Dutch disease and the response of *fiscal policy*. There appears to be no available study that has investigated the appropriate response of monetary policy to Dutch disease, specifically in oil-exporting developing countries. Therefore, this study aims to address this gap by determining how a combination of monetary and fiscal policy can be used to deal concurrently with the negative impact of Dutch disease on real non-oil GDP (or growth) and domestic prices (inflation) in MENA oil-exporting countries, using Libya as a case study. There is near consensus that monetary policy does not have a long-term impact on growth (Nelson & Plosser 1982; Samba 2013). However, it can help promote the growth of the non-oil sector by reducing inflation in the short, medium and long term; thus, this thesis investigates the response of monetary and fiscal policy to mitigate the adverse impact of Dutch disease in Libya with the objective of achieved improved growth and inflation outcomes.[28] The contribution here is that monetary policy will be based on different strategies, including a Taylor rule. The best Taylor rule for Libya will be identified to determine better outcomes regarding real non-oil GDP growth and inflation (see Chapter 7). This study will use the SVAR method, based on a theoretical macro-economic model, which is discussed in more detail in Chapter 4. Section 3.4.2 reviews the literature proposing macro-economic policy strategies to mitigate Dutch disease as a foundation to fill the empirical research gap.

3.4.2 Dutch disease and proposed macro-economic policy responses

In regards to filling the empirical research gap identified above, this study considers two views linked to macro-economic policies. The first is Corden's (2012) and the second relates to Taylor monetary rules (1993–2011). Corden (2012) suggested new theoretical concepts to mitigate Dutch disease, while Taylor monetary rules (1993–2011) are linked by the current study as a policy able to react to real GDP growth and inflation simultaneously. As mentioned in Chapter 2, the Libyan economy has performed poorly in terms of growth and inflation. In resource-endowed economies, insufficient attention has been paid to the role and importance of monetary policy in producing better output and inflation outcomes, and potentially mitigating Dutch disease effects. Sections 3.4.2.1–3.4.2.3 will review the contribution of Corden (2012) and the Taylor rules (1993–2011).

[28] As highlighted previously, Libya's outcomes in terms of growth and inflation compare poorly relative to comparable MENA countries.

3.4.2.1 Corden (2012): Recommendations for responding to Dutch disease.

Corden (2012) suggested a number of policies, including running a fiscal surplus combined with a lower interest rate and SWF to mitigate the adverse impact of Dutch disease.

3.4.2.1.1 Fiscal surplus combined with a lower interest rate

Corden (2012) discussed a framework that aims to moderate Dutch disease impact through a mechanism to depreciate the exchange rate by reducing the domestic interest rate. He proposed a policy that combined a fiscal surplus with a lower interest rate to moderate or avoid Dutch disease effects. This proposed mechanism can reduce the exchange rate appreciation caused by a boom in the resource sector and higher foreign reserves, with the objective of reducing its adverse impact on the non-resource sector. Corden (2012) argues that a fiscal surplus could be created through the ratio and proportion between tax and government expenditure. For example, increased tax and reduced government expenditure can lead to a budget surplus. This can result in reduced aggregate demand due to a contraction in government spending. However, to retain internal balance, monetary authorities must run a counteracting monetary expansion by reducing the interest rate. A decrease in domestic interest rates relative to foreign interest rates would result in depreciation[29] of the nominal exchange rate due to capital outflows, assuming a positive relationship between the exchange rate and foreign interest rate (Peters 2009; Sousa 2011; Muhanji & Ojah 2011; Mohammadzadeh 2015). This depreciation in the exchange rate is due to an increase in capital outflow and/or a decline in capital inflow, which leads to a reduction in foreign currency reserves and a depreciation in the nominal exchange rate (Mohammadzadeh 2015). Nominal exchange rate depreciation reduces non-oil imported goods; this would benefit firms in the tradeable non-oil sector of the domestic economy (Corden 2012).

[29] A rise means a depreciation, defined as the number of units of domestic currency for one unit of the foreign currency. A depreciation in the exchange rate would stimulate production of exports and import substitution (Suhendra & Anwar 2014).

In this regard, there are several mechanisms through which a lower interest rate can be achieved. First, a lower interest rate relative to the foreign interest rate can increase capital outflow and depreciate the exchange rate (Orrego & Vega 2013; Mohammadzadeh 2015). Second, a lower interest rate can encourage private investment, which enhances economic growth and reduces inflation by raising non-oil output (Mundell 1963; Bouakez & Eyquem 2015). However, this can also increase consumption demand rather than investment and further increase inflationary pressure if the demand response is more elastic relative to that of the supply response from an interest rate change in the economy. Nevertheless, interest rate change can be achieved more effectively when undertaken with a government investment program to enhance productivity and supply (Iqbal & Jamil 2015).

Government investment in public infrastructure and human capital can influence economic growth by encouraging private investment and developing skills/expertise to enable a productive capacity that can result in greater labour productivity, competitiveness, output and economic growth (Khan et al. 1990; Sinha 1997; Ali & Harvie 2017). However, for a developing country, it is a critical issue when oil revenue generated by the private sector is left in the hands of that sector to invest or consume. In the case of Libya (which has weak markets and institutions, and a small private sector; see Chapter 2), this might not be an appropriate choice. Leaving this decision to the government may be a better option. However, because of government corruption, there is a lack of capacity and transparency, and rent-seeking behaviour. In more developed economies with more developed markets and institutions and lower levels of corruption/rent-seeking behaviour, greater transparency and a larger private sector, the decision may be to leave the oil revenue mainly in the private sector (e.g., as in Australia and the UK).

Oregon and Vega (2013) argue that when the government of an oil-abundant economy spends more than the oil tax revenue it obtains and there is no fiscal surplus, the central bank should lower interest rates to reduce appreciation of the exchange rate and alleviate Dutch disease effects. In some cases, this can result in higher inflation, especially when it is in conjunction with an increased fiscal expansion that spends more on consumption relative to investment/productivity-enhancing activity. This would augment the effects of Dutch disease, as it causes consumer imports to grow faster than non-oil exports in the non-oil trade balance. In other words, in this case of a fiscal deficit or lower surplus, the government has to borrow from the central bank. Thus, money supply would expand, the interest rate would fall, demand would rise, and inflation would increase. While the interest rate would depreciate the exchange rate, which improves international competitiveness, the higher inflation would increase prices and offset the gain in competitiveness. To depreciate the exchange rate, Corden (2012) provided another option—investing oil revenue overseas through a SWF. This will be explained in Section 3.4.1.2.

3.4.2.1.2 Sovereign wealth fund and/or domestic future fund

Oil revenue can also or alternatively be allocated to a SWF to be invested overseas in an internationally diversified portfolio of income-earning assets. This reduces risk and expands investment opportunities, which might be limited in the domestic economy (Corden 2012; Ahmed & Kulsh 2014). One of the most well-known examples in the literature on spending resource revenue on investment rather than public consumption is that of Norway, which created an SWF through which revenues from oil and gas were invested overseas. Chile also created an SWF to manage resource revenue (Mohammadzadeh 2015). This can also result in capital outflows, which weaken the currency. A lower interest rate in the domestic economy may encourage domestic investment, which could improve supply. Conversely, it could also result in capital outflow and a further weakening of the currency, which would improve the competitiveness of the non-oil tradeable sector (Van der Ploeg 2011). When the government invests oil revenues overseas, it places the same downward pressure on the currency. Investment of oil revenues overseas reduces the amount of oil revenue in the domestic economy, which leads to reduced consumption expenditure and lower inflation. This can provide two advantages. First, a depreciation of the real exchange rate due to capital outflow and accumulation in national savings, which is invested abroad. Investment of oil revenues overseas reduces the amount of income in the domestic economy. Increased overseas savings and investment support the domestic economy against the negative shock of oil prices and generate a future flow of income when the oil runs out (Van der Ploeg 2011). However, this means less investment in the domestic economy, which could result in lower future productivity and growth. It may also trigger slower employment generation in the domestic economy unless the growth of non-oil non-tradeable sectors is rapid. However,this strategy can be more applicable for a high-income and capital abundant country, such as Norway and Kuwait. While, for limited countries with low income, scarcity of capital and limited tax capacity, such as Gabon, the application of this strategy can adversely affect the current generations of local people (Van der Ploeg & Venables 2011).

Corden (2012) contended that oil revenue ought to be invested in a SWF that contributes reserves abroad. Thus, revenue arising due to resource exports in resource shock periods or from foreign exchange reserves held by the central bank should be involved in the SWF. This will lead to depreciation in the real exchange rate and mitigate Dutch disease effects when combined with a fiscal surplus and associated interest rate adjustment. In addition, an SWF can diversify the portfolio of financial assets and foundation of future income. An example of such a fund is be the Government Pension Fund of Norway, also known as the Oil Fund.

However, for developing counties that suffer from poverty, high rates of unemployment and wide variations among individuals, the use of these funds in SWFs affects development. It can become a lost opportunity to improve a country's infrastructure and the social security system, which are key factors from a political and development perspective (Gylfason 2001; Polterovich et al. 2010, cited in Kropf 2010 and Ali-Mohamed 2014). Effectively using such revenues to develop infrastructure and domestic industrialisation would increase supply, make the economy resistant to the resource shock effect in the short term and avoid depletion of resources in the future.

According to Corden (2012) and Harvie (2019), if the objective of the fiscal surplus and its investment is to moderate Dutch disease effects, it is better to invest abroad. Hence, an SWF should be preferred to a domestically investing future fund (DFF). However, there is concern about the decision between investing in the domestic economy (via a DFF) and overseas (via an SWF) or a combination of both (DFF/SWF), where the objective of alleviating Dutch disease depends on the degree of substitutability between domestic and foreign assets. If they are perfect substitutes, a distinction between the DFF and SWF erodes, the case for utilising the DFF weakens, and funds invested overseas are equivalent to having only an SWF. This occurs because the DFF in this instance would not affect rates of return domestically, just as the SWF has no such effect internationally. Whether the fiscal surplus were invested abroad (via the SWF) or at home (via the DFF), the outcome can be similar.

Alternatively, when foreign and domestic assets are less substitutable, as is more likely in developing economies, there is a greater likelihood of establishing both a DFF and an SWF. Therefore, there is a case for creating an SWF in addition to a DFF. As the degree of substitutability increases, the case for doing so weakens (Corden 2012). Thus, a fiscal surplus along with an 'internal balance' monetary policy would reduce Dutch disease effects, even when funds made available by the fiscal surplus wholly finance domestic private investment. Further, Frankel (2010) suggested some strategies when foreign exchange reserves move to excessive levels. One is that government should pay off the country's debt, especially short-term debt. Another is to remove any obstacles to domestic citizens investing overseas and place some limitations on capital inflows. The last strategy is in line with Corden (2012) although he suggests attempting this via a reduced domestic interest rate to depreciate the exchange rate. The impending depreciation controls capital inflows and increases capital outflow. This reduces the exchange rate appreciation with increasing foreign exchange reserves.

The current study suggests and investigates another policy that could alleviate Dutch disease. It involves the adoption of monetary policy in accordance with Taylor rules. This will be reviewed in Section 3.4.2.2.

3.4.2.2 Taylor monetary rules (1993–2011)—response linked to Dutch disease

The current study suggests that the adoption of monetary policy in accordance with the Taylor rules constitutes another policy able to mitigate Dutch disease. This section reviews the Taylor monetary rules and their key historical iterations from 1993, when their use was proposed for a developed, large, closed economy (US) until 2011,

when their use was proposed for a developed, small, open, oil-exporting economy (Norway).

A key aim of the current study is to investigate the efficacy of the Taylor rules and whether they can be used by the Libyan central bank to operationalise monetary policy to leverage better outcomes with regard to real GDP and inflation. Further, it aims to determine whether Taylor rules can contribute towards offsetting Dutch disease effects in this resource-abundant economy. As Libya is a small, open economy that produces and exports a large amount of oil, the exchange rate plays a pivotal role in the adjustment process. Hence, this review not only focuses on the original Taylor rule (for a closed economy), it also considers an extended version of the Taylor rule for an open economy (Laurence-Ball 1999; Svensson 2000; Taylor 1999b, 2000), and where the economy is a net oil exporter and developed economy (Balabay 2011).

In 1993, John Taylor formulated his famous rule that established a new way for policymakers to think about monetary policy. It considers key macro-economic factors, output and inflation simultaneously. It shows a linear dependence of the central bank's interest rate on the output gap and the deviation of current inflation from their targeted values (Balabay 2011). Both these targets can be used separately and independently.

Taylor's (1993) rule and its extensions (e.g., Clarida et al. 1999) assume that interest rates react linearly to the gap between actual and desired values of inflation and output (KASAI 2011; Taylor 2001). Taylor used this model to describe US monetary policy with a high degree of accuracy for 1987–1992. The Taylor rule has since become popular among economists (both academic and policymaking) who study and implement monetary policy (Laurence-Ball 1999; Clarida et al. 1999; Svensson 2000; Balabay 2011) and, with some modifications of the original model, attempt to gain more realistic results (KASAI 2011; Balabay 2011). It has become widely used as a simple way to describe and evaluate monetary policy in a number of countries. The original Taylor rule will now be reviewed and extended.

The initial Taylor rule (1993) is illustrated in Equation 3.1:

$$r_t = \alpha + \beta_y(y_t - y_t^*) + \beta_\pi(\pi_t - \pi_t^*) \qquad 3.1$$

where r_t represents the nominal short-term policy interest rate. The term $(y_t - y_t^*)$ represents the output gap (deviations in actual output from its targeted, or potential value (y_t^*), whilst $(\pi_t - \pi_t^*)$ represents the deviation in the actual inflation rate from its targeted value. The parameters β_y and β_π reflect the relative importance of the deviations of output and inflation from their targeted values (Kasai 2011). This means that the central bank should reduce the nominal interest rate in response to real output being below its potential level and inflation below its target rate. Therefore, the original Taylor rule shown in Equation 3.1 implies that the nominal interest rate of the central bank is not simply set at the level of the equilibrium real interest rate r_t^* (the natural rate) plus inflation (the intercept $\alpha = r_t^* + \pi$) (Balabay 2011). Taylor (1993 p. 210) claimed:

> Operating a monetary policy rule in the face of an oil-price shock is difficult in the perspective of an oil-exporting country and deserves particular study. It is even more difficult if the shock occurs during a transition to a new policy rule with lower inflation as perhaps was occurring in the early 1990s.

Making use of a specific rule, as shown in Equation 3.1, is important in this case. Taylor's (1993) rule reflects the links between the oil-price shocks that occurred in early 1990 to monetary tightening that increased the US federal funds rate to reduce inflation, which had been strongly influenced by higher economic growth in 1987–1988. However, such tightening led to slower economic growth in the period following.

The original Taylor rule was not econometrically estimated. The parameters were chosen with plausible values. Taylor put both beta values at 0.5. The inflation target was assumed to be equal to 2%, as was the equilibrium real interest rate.

$$r_t = 2 + \pi_t + 0.5(y_t - y_t^*) + 0.5(\pi_t - 2) \quad (3.2)$$

With central banks following monetary strategies focused on the adjustment of interest rates, fiscal policy was also used in response to any negative effects on real output and employment in that oil price shock period. The current study will add to the latter by considering fiscal policy in its analysis of a Taylor rule. According to Taylor, 'the possibility of over-riding the automatic stabilizers — offsetting them by increasing taxes or reducing expenditures' may be proposed, as has been the case with international policymakers in the past (Taylor 1993, p. 211). The current study considers this from a different viewpoint, where increased government spending for investment combined with a reduction in government spending for consumption is assumed to generate the output (see Chapter 7).

In relation to the second generation of Taylor rules, economists have argued that the exchange rate is an important instrument, which acts as a transmission mechanism of policy in a small, open economy (Ball 1999; Svensson 2000; Taylor 1999b). They suggested policymakers should intensify their focus on how the interest rate reacts to the exchange rate[30] and how this influences macro-economic indicators in the domestic economy, such as inflation and real GDP. The exchange rate also has an impact on the trade balance (Taylor 2001). Thus, Ball (1999), Svensson (2000) and Taylor (1999b) developed a version of the Taylor rule for a small, open economy with 'sticky prices', such as New Zealand, which incorporates exchange rate implications as shown in Equation 3.3. In this equation, (r_t) denotes the nominal interest rate set by a central bank in the short term. The variables (e_t) and (e_{t-1}) represent the real exchange rate and its lag, where an increase in (e_t) is equivalent to an appreciation in the exchange rate. There is no intercept term because this model is applied under the assumption that the inflation target is zero and the interest and exchange rates are measured relative to long-term steady state values (Taylor 2001). The parameters h_0 and h_1 indicate optimal policy parameter values, which change the interest rate to absorb the appreciation in the exchange rate. The results provided by Ball (1999) are consistent with the interpretation of the rule of thumb provided by Obstfeld and Rogoff (1995), where these coefficients would be less than zero. Hence, when there is an appreciation in the exchange rate by 10%, the interest rate shows a reduced response of 3.7 percentage points. This is followed by a partial offset of 1.7 percentage points, which translates to a long-term interest rate reduction of 2 percentage-points.

[30] Most models used for policy evaluation assume perfect capital mobility; they either have an *ex ante* interest-rate parity condition or a reduced-form relationship between the real interest rate and real exchange rate implied by such a relationship (Taylor 2001).

Taylor (2001) suggested that Ball's (1999) model for an open economy can be considered more robust compared to a rule in which both (h_0, h_1) parameters are equal to zero.

Moreover, another group of researchers, including Levin et al. (1999), Clarida et al. argued the goal of domestic monetary policy is to retain stability, which means that central banks tend to smooth their interest rates. Clarida et al. (1998, 1999, 2000) assumed ρ to be between 0.8 and 0.9 for quarterly data.

$$r_t = (1-\rho)(g(y_t - y_t^*) + f(\pi_t) + h_0\, e_t + h_1\, e_{t-1}) + \rho r_{t-1} \tag{3.3}$$

This model has been further augmented by Balabay (2011) by including an oil price shock into equation 3.3. Balabay (2011) claims that in oil-exporting countries, appreciation of the real exchange rate can be attributed to oil price shocks. Since oil is Norway's major export commodity, this may influence policymakers when they dissect all relevant information and make policy decisions. For example, policymakers must understand the interaction between the domestic interest rate and real exchange rate. If the interest rate policy leads to a depreciation of the real exchange rate, this depreciation would lead to higher import prices, and further inflationary pressure through indirect impacts such as higher wages and foreign demand. Hence, any change in the interest rate that has a negative relationship with oil prices can sustain the real exchange rate at the desired value to improve the output of the non-oil sector (Balabay 2011).

It can be concluded that a lower interest rate can mitigate the appreciation of the nominal exchange rate to improve macro-economic outcomes in terms of real GDP and inflation in an open, oil-exporting economy (Obstfeld & Rogoff 1995; Ball 1999; Svensson 2000; Taylor 1999b, 2000). These arguments are more consistent with recent Dutch disease models, such as those constructed by Corden (2012) and Balabay (2011). These authors applied their models pragmatically and posited solutions to the effects of Dutch disease, particularly in the context of resource-rich countries. These scholars tested the developed versions of the Taylor rule for developed countries such as the US, Australia and Norway. No study appears to have investigated the response of monetary policy including a Taylor rule to Dutch disease in oil-exporting countries. The discussion of these points is summarised in Table 3.1 at the end of this chapter.

3.4.2.3 Discussion on mobilising the empirical research gap

In an extension to macro-economic policies (see Section 3.4.1), other views have been proposed to mitigate Dutch disease. The principal views that will be considered in the empirical analysis of this thesis to fill the research gap are suggested by Corden (2012). These are likely to have been analysed yet by any empirical study. Based on the empirical review (see Section 3.4.1), this especially includes MENA countries. Corden (2012) and Harvie (2019) argue that the mitigation of Dutch disease can be conducted through a macro-stabilisation policy that includes running a fiscal surplus, lowering the interest rate and possibly establishing an SWF. While the current study investigates running a fiscal surplus combined with lowering the interest rate, it leaves the creation of an SWF for future research.

A linking of Taylor monetary rules to the analysis of Dutch disease can be used to examine how monetary policy can manage the negative impact of Dutch disease on GDP growth and inflation. The review of Taylor monetary rules (1993–2011) reveals that scholars have tested the developed versions of the Taylor rule for developed countries, such the US, Australia and Norway.

This study will select the most appropriate version for Libya's stage of development. This will be shown and tested in Chapter 7 with some amendments, which link both Corden (2012) and Taylor rules, including fiscal and monetary policy under an oil price shock, aim at mitigating Dutch disease effects by targeting real non-oil GDP growth and inflation (see Chapter 7). This in line with a recommendation by Taylor (1993, p. 211) when he mentioned the policy of the original Taylor rule, which suits economies like that of the US. He also mentions the role of fiscal policy in some economies to generate increased non-oil output under an oil price shock. No extant study seems to have investigated the response of monetary policy, including a Taylor rule with fiscal policy, to address Dutch disease, especially for developing oil-exporting countries. Considering fiscal policy with Taylor monetary rules for developing countries can address a gap in the literature; the current study is a modest attempt aimed at filling this gap. However, future research by this study's researcher will investigate this closely.

3.5 Conclusion

This chapter aimed to provide a sound foundation for the investigation of Dutch disease and the identification of appropriate macro-economic policy responses that will contribute to developing the methodology used in this thesis (see Chapter 4). It also identified the research gap, which will provide the focus of the empirical analysis presented in this thesis (see Chapters 5, 6 and 7).

To achieve these aims, this chapter first reviewed the most relevant literature to explain and analyse the so-called resource curse and how this phenomenon is closely related to economies with abundant resources and low economic growth. The term 'resource curse' is broad and involves many factors; the focus was on Dutch disease, which is more related to the current study. The review of empirical literature ignores the resource movement effect and focuses on exchange rate appreciation and spending effects of Dutch disease, and how macro-economic policies react in this context. The aim of the empirical evidence section is to review the existence of macro-economic policies reacting to Dutch disease; these were analysed in the empirical literature and the research gap was identified. The current study will fill this gap through the linkage of monetary policy to Dutch disease using two views: Corden's (2012) and Taylor's monetary rule (1993–2011). Chapter 4 will develop the macro-economic theoretical model that is used as the theoretical foundation for the empirical analysis in Chapters 5, 6 and 7.

Table 3.1

Summary of Existing Literature Showing Response to Dutch Disease and Generating Research Gap

Main issues emphasised	**Author**	**Country**	**Period**	**Method**	**Results are statistically significant**	**Key policy recommendation to mitigate Dutch disease**
Exchange rate appreciation (exchange rate regime)	Harvie (1993)	UK	1970–1989	Numerical simulation via Saddle point analysis	1. Non-oil GDP decreases irrespective of exchange rate regime, but this decline is worse in fixed exchange rate 2. Inflation falls sharply with a fixed rate on impact, due to the BoP impact on monetary growth rate, but quickly reverses. With a flexible rate, inflation initially increases, then declines (p.277)	Move from fixed to flexible exchange rate regime
Exchange rate appreciation(exchange rate regime)	Adeleke (2014)	AOECs	1970–2010	The impulse response function of SVAR	1. The impact was more significant in countries with a fixed exchange rate (such as Gabon and Libya) compared to those with a flexible exchange rate (Nigeria and Algeria). 2. This implies that inflation in Libya and Gabon is higher than in nations with a flexible exchange rate and most likely a structural influence of the decline of non-oil output	Move from fixed to flexible exchange rate regime

Exchange rate appreciation (exchange rate regime mechanism)	Omolade & Ngalawa (2017)	Libya and Nigeria	1980–2010	The impulse response function of SVAR	1: the growth in the manufacturing output under a flexible exchange rate is slightly more significant than that under a fixed exchange rate 2: that inflation under flexible exchange rate does not follow the path of manufacturing output and so inflation it is likely to be more monetary	Move from fixed to flexible exchange rate regime
Government spending effect (fiscal policy mechanism)	Mahmoudzadi (2015)	Australia	1988–2011	The impulse response function of DSGE	Government investment expenditure enhances both demand and supply and has a positive impact on the output of the non-resource sector GDP	Government should shift the focus from consumption expenditure (demand) to higher levels of investment expenditure
Government spending effect (fiscal policy mechanism)	Ali (2011)	Libya	1970–2007	Numerical simulation of ARDL	1. Government focus on expenditure for consumption; this generates demand for consumption, so government spending on consumption has a negative impact on the GDP of the non-oil sector and lifts domestic prices 2. Increased demand for non-tradeable goods results in a deterioration in output of non-resource tradeable goods	Focus on government spending for investment, development more than government spending for consumption

Exchange rate & spending effect (fiscal & monetary policy mechanism)	Corden (2012)	*Empirical research gap*	Fiscal budget surplus combined with a lower interest rate
Exchange rate & spending effect (fiscal & monetary policy mechanism)	Corden (2012) Harvie (2019)		SWF, invest oil revenue overseas*
Exchange rate, interest rate & government spending (fiscal & monetary policy mechanism)	Taylor (1993) Researcher of current study		Combination of Taylor monetary rule and fiscal policy in terms of government spending

* SWF will be the subject of future analysis by this researcher

Chapter 4: Methodology

4.1 Introduction

This chapter develops a theoretical macro-economic model that will provide the basis of the empirical analysis conducted in this thesis. The model will be as representative of the Libyan economy as possible. The model is an adaptation and extension of the Cox and Harvie (2010) model (see Section 4.2). Cox and Harvie's (2010) model is a useful starting point for this study, as it is designed for a small, open natural resource-producing and exporting economy in which the spending effects from the resource sector dominates. The model emphasises the role of government as the major owner of natural resources and main recipient of resource rents and, hence, the major intermediary through which oil-related shocks are transmitted. Consequently, analyses of the impact of changes in the resource sector on the macro-economy are strongly linked to government and its policy responses. However, the Cox and Harvie (2010) model was created for a developed economy with sophisticated financial markets and a flexible exchange rate system. Therefore, modifications and extensions to the Cox and Harvie (2010) model are required to analyse the impact of oil price shocks and macro-economic policies responses in a net oil-exporting developing economy such as Libya. This economy labours under conditions of a managed floating exchange rate, a high degree of control over international capital mobility by the monetary authority, and a weak contribution of the private sector in economic activities (Ali 2011; Ahmouda 2014; Alimohamed 2014). Estimation of this model will use proxy variables since the Cox and Harvie (2010) model requires relevant data that is not readily available for a developing economy such as Libya's.

The structure of this chapter is as follows. Section 4.2 explains the theoretical model and macro-economic framework. Section 4.3 reviews the theoretical background of the modelling approach. Section 4.4 outlines the specifications of matrices and their equations through four models (pure Dutch disease, oil price shock and fiscal policy, oil price shock and monetary policy, and oil price shocks and both fiscal and monetary policies) using the SVAR approach to determine the best policy responses for Dutch disease in Libya. It uses GDP and non-oil GDP (or growth) and domestic prices (or inflation) as key macro-economic outcomes for each case. This will be further discussed in Chapter 7. Section 4.4 summarises the major conclusions from the chapter.

4.2 Theoretical Model and Macro-Economic Framework

This section explains and develops a macro-economic model for a small, open, oil-exporting economy to analyse the impact of an oil shock, particularly an oil price shock, on other macro-economic variables; Libya is used as an example. The Libyan government owns the oil sector and revenue derived from it dominates budget revenue, exports and GDP. Thus, a boom in the oil sector affects the non-oil sectors in several ways (see Chapter 3): the revenue/income effect and wealth effect (spending effects), the exchange rate and current account effect, and the resource movement effect (Edwik 2007; Ali 2011; Cox & Harvie 2010; Fargani 2013). Therefore, these need to be incorporated in the model. As explained in Chapter 3, oil booms and their effects on the economy contribute to what is known as Dutch disease.

The model developed will link the impact of oil shocks on the Libyan economy with the government sector and its macro-economic policy responses. The theoretical starting point is the Cox and Harvie (2010) macro-economic model for a resource-exporting economy. This is then adapted to analyse Libya to determine possible strategies that might mitigate the adverse effects of oil booms in this small, open oil-exporting country, in particular on GDP growth and inflation. Section 4.2.1 will briefly review the Cox and Harvie (2010) model and justify its use as the basis of the theoretical framework adopted in this study.

4.2.1 Background to macro-economic model

Considerable extant literature analyses and models the impact of natural resource production on the growth performance in small, open resource-based economies in the short and long term. During the 1980s, a number of studies emphasised that resource production shocks affect the economy, specifically in the short run, through several channels: the exchange rate, resource movement, spending income and exchange rate effects. The short-term effects focused in particular on the exchange rate effect in the context of a Dornbusch (1976) type model (see for example Buiter & Miller 1981; Buiter & Purvis 1983; Eastwood & Venables 1982; Wijnbergen 1981). Economic agents have forward-focused expectations; the exchange rate is flexible and prices are sticky (see Dornbusch 1976). Sticky prices are sticky to run the model and explain the results for countries underlying their studies.

Literature was extended during the 1990s to incorporate medium- and long-term dynamic effects, such as capital stock accumulation, foreign asset stock accumulation via the current account and financing of the fiscal budget. Additionally, the literature considered adjustment to Dutch disease under different exchange rate regimes (fixed or flexible) (see for example Harvie 1993; Ali & Harvie 2015b). More recently, Aregbeyen and Kolawole (2015) and Ali and Harvie (2017) investigated the impact of oil production on economic growth and the response of fiscal policy to Dutch disease. Ali and Harvie (2017) showed how government investment in productivity-enhancing measures (e.g., infrastructure, education, health and imported technology) could improve non-oil output supply and reduce the negative impact of Dutch disease (Ali & Harvie 2013, 2017; Mohammadzadeh 2015).

While much emphasis has been placed on the role of fiscal policy in addressing the adverse effects of Dutch disease, the potential contribution of monetary policy should not be ignored. The linkage between fiscal policy and monetary policy is particularly obvious in MENA countries, where financial institutions and markets are underdeveloped and government budgetary deficits need to be financed by central banks, resulting in monetary accommodation. Therefore, fiscal and monetary policy are closely linked. Poorly devised fiscal strategies to address Dutch disease can leave a legacy of limited economic growth and rapid growth of money supply and inflation. In addition, fiscal policy tends to operate with a lagged effect due to legislative and other delays, which prevents it from rapidly responding to unexpected contemporaneous fluctuations of economic activity in the short term. Monetary policy can be more responsive to the movements of GDP and inflation through interest rate and exchange rate instruments (Alkahtani 2013).

The Cox and Harvie (2010) model is a long-term dynamic macro-economic model for a developed, resource-exporting economy aimed at reducing Dutch disease effects on key macro-economic variables and possible fiscal policy responses to improve macro-economic outcomes. It emphasises a number of effects—spending (or wealth) effect, income effect, revenue effect, current account effect and exchange rate effect—and contains four main sectors: a product market, assets market, aggregate supply and price sector, and an overseas or foreign sector (see Cox and Harvie 2010, p. 470)

The Cox and Harvie (2010) framework is based on a number of assumptions. First, economic agents possess forward-focused expectations. Second, non-financial markets are not in continual equilibrium, as they are subject to slow adjustment of quantities and price stickiness. Third, financial markets clear instantaneously, so that they are continually in equilibrium. This implies that financial variables, such as the exchange and interest rate, can make discontinuous jumps to ensure financial markets remain in equilibrium. The impact of shocks is transmitted first through financial markets, and transmitted to the product and labour markets. Fourth, the asset market includes four financial assets: domestic money, domestic bonds, foreign bonds and equities. Three of these assets, domestic bonds, foreign bonds and equities, are assumed to be perfect substitutes as perceived by investors.

Fifth, capital stock accumulation, the fiscal budget and current account must be in balance to ensure a long-term steady state. Otherwise, wealth will continually accumulate and a steady state cannot be achieved. As a result, there is a link between the short and long term through the accumulation of physical and financial capital stock in the non-resource sector. Investment leads to the accumulation of physical capital stock, increased productivity and non-resource output. Developments in the current account result in an accumulation of foreign assets, and budgetary financing increases the money supply, which can result in financial capital stock accumulation in the private sector.

Sixth, the model considers both the demand and supply sides of non-resource output. The supply of non-resource output is assumed to be endogenous and can change due to capital stock accumulation in the non-resource sector (including infrastructure), which contributes to increased output capacity and productivity in this sector. Hence, economic growth is incorporated in the model. Finally, the economy is assumed to be a net resource-producing/exporting economy. Resource production is assumed to be exogenous, while resource exports are assumed to be endogenous.[31] External or domestic shocks are assumed to have no impact on resource production. Desired government capital expenditure is considered exogenous.

This thesis uses the Cox and Harvie (2010) model as a starting point to develop a theoretical model for Libya but with suitable amendments. Cox and Harvie's model explains how resource price shocks are transmitted to key macro-economic variables (economic growth and inflation in particular in the context of this study), which is consistent with the primary aims of this research.

4.2.2 Extension of the Cox and Harvie (2010) model to a developing resource-dependent and exporting economy such as Libya's

The Cox and Harvie (2010) theoretical model evaluates the transmission mechanism of resource price shocks and fiscal policy responses in the context of a developed economy under the hypothesis of forward-looking rational expectations. However, this model must be adjusted to make it applicable for an oil-producing/exporting developing economy. For this purpose, modifications and extensions were implemented to achieve the research objectives of this study (see Chapter 1). The Cox and Harvie (2010) model evaluates the transmission mechanism of resource price shocks for a developed economy, such as Australia, where financial markets are sophisticated in terms of depth and breadth. Since the transmission mechanism is different between developed and developing economies, the model used in this study is developed to make it more appropriate for an oil-producing/exporting developing economy.

First, while the private sector plays an essential role in developed economies, it makes a secondary contribution in developing countries (see Chapter 2). In Libya, an oil shock is transmitted to the rest of economy depending on how the government spends this revenue. The oil sector, oil revenue and government spending are under government

[31] That is, the proportion of oil production that is exported is variable and endogenous in the model.

control. The government could also invest these funds overseas in income-generating foreign assets. It could also pay off government debt. These two possibilities are beyond the scope of this study.

Second, public consumption expenditure represents current spending on wages and salaries, and imported consumption goods. These stimulate demand for non-oil output but do not exert a long-term and sustainable impact on the economy. Development expenditure (public investment expenditure) can boost non-oil output supply, and increase demand for non-oil output (Ali & Harvie 2015; Alimohamed 2014). Public investment expenditure will impact the economy beyond the current period.

Third, the Cox and Harvie (2010) model assumes that domestic private sector wealth plays an important role via its effect on increasing demand for financial assets and non-resource output. Wealth consists of the domestic currency value of foreign asset stocks held, the value of privately owned, physical capital stock, real money balances, real bond balances and the permanent value of resources. This is unlikely to apply to a developing economy such as Libya's, in which the public sector dominates economic activities and the private sector constitutes a small part of non-oil output and has no ownership rights over oil resources (IMF 2008; Ali 2011; Ahmouda 2014; see Chapter2). Fourth, based on the previous assumption, private consumption increases primarily through a liquidity effect (Lim et. al 2007; Dungey & Pagan 2000; 2009). Private sector wealth only consists of real money balances since no bonds, domestic or foreign, are held. Therefore, private sector wealth is much more narrowly defined in this model. Hence, the model developed for Libya assumes private consumption increases through a liquidity effect (real money supply can be used as a proxy).

In regards to the response of private consumption to interest rate changes, the study assumes that this response would not be contemporaneous. In developed countries, the interest rate has a direct impact on demand for consumption and investment. In developing countries, the impact of interest rates on demand for consumption and investment is assumed to occur with a lag. Policy changes are not regularly and immediately passed on to the public. The government makes a policy decision, but it takes time for this to be communicated to the public due to the credibility gap and undeveloped information systems to transfer the information between policymakers and the public (Us 2004). Therefore, the response of private investment and private consumption to changes in the interest rate are assumed to occur with a lag. This will be tested in Chapter 6 of this thesis.

Fifth, Cox and Harvie (2010) assumed that desired government consumption expenditure is exogenous. Consistent with this, the model for Libya assumes that government consumption spending is exogenous and based purely on government policy decisions. Government policy decisions determine the proportion of oil revenue to be spent on consumption.

Sixth, it is assumed in the Cox and Harvie (2010) model that the budget deficit is financed through monetary accommodation or sales of government liabilities, and government bonds issued. In developing countries with imperfect asset markets, the budget deficit is primarily financed through monetary accommodation and foreign exchange reserves from oil sales, or from borrowing from overseas (Romer 1983).

Seventh, Cox and Harvie assume four financial assets (domestic money, domestic bonds, foreign bonds and equities) are available in the economy of their study. In the case of Libya, with imperfect financial markets and incomplete information, it is assumed that there is only one financial asset, a money asset, as in the Ali & Harvie (2013, 2017) model. This suggests that the government does not operate a separate monetary policy. Monetary policy is simply based on funding the budget deficit. The model developed in this study assumes that only the nominal interest rate and discount rate (where the central bank uses these certain instruments to influence the money supply) can contribute to changes in the money supply. However, financing the budget deficit has an impact on money supply (Ruhaet 2010) and, if a fixed exchange rate regime is adopted, BoP surpluses and deficits will also affect money supply through changes in foreign exchange reserve.

Eighth, the Cox and Harvie (2010) model assumes a flexible exchange rate. In this study, macro-economic outcomes will be compared under both a fixed and flexible exchange rate system to provide evidence on the appropriate exchange rate policy to promote low inflationary economic growth in Libya. This will be analysed in Chapter 7, which will examine Dutch disease and the response of both fiscal and monetary policy. This will be included in one system of SVAR and under different exchange rate regimes. As known, under a fixed (managed) exchange rate regime, money supply becomes endogenous. If there is perfect capital mobility, the domestic interest rate is determined by the world interest rate. Monetary policy is then ineffective. Under a floating exchange rate, money supply is exogenous and monetary policy is effective. The more fixed the exchange rate, the less control it has over money supply. Thus, the matrices of SVAR in Chapters 6 and 7 will be consistent with this context.

In conclusion, the Cox and Harvie (2010) model is extended in this study in three critical ways. First, it will emphasise the effects of Dutch disease specifically on economic growth and inflation. Second, it will explicitly incorporate monetary policy in addressing Dutch disease. Third, a Taylor rule monetary policy for the interest and exchange rate will be used in the monetary sector, providing an additional policy tool to reduce adverse macro-economic impacts, specifically GDP growth and inflation, as emphasised in this study.

Through analysis of six variants of the base model, this study will demonstrate how best macro-economic policies (fiscal, monetary and exchange rate regimes specifically) should be used in response to Dutch disease effects. The first model demonstrates pure Dutch disease effects (see Chapter 5). The second combines pure Dutch disease effects with a fiscal policy response (under oil price shocks) (see Chapter 6). The third model shows pure Dutch disease in conjunction with a monetary policy response (under oil price shocks and foreign interest rate shocks) (see Chapter 6). All these models are assumed to operate under a managed exchange rate regime.

A fourth variant of the basic model analyses the influence of a fiscal policy response to Dutch disease under a flexible exchange rate. The fifth model demonstrates the influence of both fiscal and monetary policies on Dutch disease effects under a flexible exchange rate. The sixth model displays the influence of both fiscal and monetary policies (Taylor rules) to Dutch disease effects under a flexible exchange rate. This will enable identification of which combinations of fiscal and monetary policies (under different exchange rate regimes) can produce the best outcomes in terms of RNOGDP (or growth) and domestic prices (or inflation). These are the major extensions to the Cox and Harvie (2010) model. All these models will be explained in depth in Chapters 5, 6 and 7.

4.3 Theoretical Framework and Model Equations for the Libyan Economy Model

4.3.1 Model equations

This section will discuss the equations of the theoretical model for Libya adopted in this study. All variables in these equations are expressed in log form except for the domestic and world interest rate (US federal fund rate). The elasticity of each variable is presented by their coefficients (Wooldridge 2013). Overall, equilibrium in the model depends on equilibrium in three markets: the product market, the asset market and the foreign (external) sector. The Mathematical Notation of the Theoretical Model is shown in Table A4.1, Appendix 4.

4.3.1.1 Product market

The product market includes 17 equations, which are shown in SVAR form by Equations (4.1)–(4.17). In the case of Libya, the supply side of the product market consists of non-oil output, which is assumed to be determined endogenously, and oil production, which is assumed to be determined exogenously. Thus, the study will not model oil production since Libyan oil production is under government control (Mezran et al. 2013; Ali & Harvie 2015a), so this model distinguishes non-oil output out of total (gross) output that consists of both non-oil and oil production. It considers equilibrium in the non-oil product market, which involves an analysis of both sides of the non-oil sector, aggregate demand and aggregate supply, in which demand for non-oil output (non-oil demand = C + I + G + (X – M) must equal non-oil output supply. In the long term, non-resource output supply is not fixed (at some natural level of output) but instead can vary based on capital stock accumulation or reduction in the non-resource sector (Cox & Harvie 2010). Developments in the supply of non-resource output indicate a change in potential output supply in this sector, and so it is endogenously determined and must change to equate with demand to achieve equilibrium in the product market (Suranovic

2010). Also, in a long-run steady state, capital stock accumulation in the non-resource sector must cease, and the current account and fiscal budget must also be in balance (Cox & Harvie 2010). Otherwise, further macro-economic adjustment will occur and a steady state equilibrium cannot be achieved.

Demand for non-oil output $\left(No_t^d\right)$ is shown in Equation (4.1). Total demand (spending) for non-oil output $\left(No_t^d\right)$ consists of the sum of private consumption spending (con_t^p), private investment spending (i_t^p), government spending (g_t) which is composed of a weighted average of government consumption and government investment spending and the non-oil trade balance (NTP_t), which is the difference between non-oil exports (x_t^n) and imports (m_t^n). The parameters a_{t-i}^i represent the spending elasticities of each expenditure component. This model is dynamic, so it captures variables in the level and with a lag for time (t) and the number of lags (i).

$$No_t^d = c_1 + \sum_{i=1}^{K} a_{11}^i \, con_{t-i}^p + \sum_{i=1}^{K} a_{12}^i \, i_{t-i}^p + \sum_{i=1}^{K} a_{13}^i \, g_{t-i} + \sum_{i=1}^{K} a_{15}^i \, (NTP_{t-i}) \qquad 4.1$$

Private sector consumption expenditure (con_t^p) is given by Equation (4.2). It depends positively on current real income, which is represented by the sum of income generated from oil and non-oil production (y_t^{RI}) and private sector wealth (w_t^p). Based on the Keynesian approach, current consumption depends on current income and wealth (Romer 2012); wealth is assumed to be the discounted value of future non-oil and oil income (permanent income).

According to Tobin (1969), Floyd (1972) and Cox and Harvie (2010), the private wealth equation includes real money balances, real bond balances (government bonds purchased by the private sector) and net physical capital assets (held by the private sector). In the case of Libya, this study only considers real money balances $(M = m_t^S - p_t)$, which are used as a proxy for the private sector wealth effect. Libyan data for real money balances is readily available. No government bonds are purchased by the private sector, as the Libyan government issues bonds to the central bank only. It does not issue bonds to the public and the public cannot buy bonds due to the lack of relevant financial institutions and markets in the economy (Ali & Harvie 2015; Central Bank of Libya 2016). As Libya is a developing country that suffers from a lack of data in this regard, it is difficult to measure net capital assets held by the private sector. Thus, real money balances held by the private sector is the best proxy available.

$$con_t^p = c_2 + \sum_{i=1}^{K} a_{22}^i \, y_{t-i}^{RI} + \sum_{i=1}^{K} a_{23}^i \, (m_{t-i}^S - p_{t-i}) \qquad 4.2$$

Private sector gross investment (i_t^p) in both the resource (oil) and non-resource (non-oil) sector are based on Tobin's (1969) q in each sector (Mohammadzadeh 2015). Tobin's q is the ratio of a physical asset's market value to its replacement value (Fumio 1982). As the government owns the oil sector, it is assumed that private sector gross investment is allocated to the non-oil sector.

Private sector gross investment (i_t^p) equals the change in the stock of private capital[32] $\left(\dot{k}_{t-i}^p\right)$,which is based on Tobin's q ratio for the non-oil sector as shown in Equations (4.3) and (4.4) of this model.

$$i_{t-i}^p = \eta q_{t\_i}^{no} \qquad 4.3$$

$$\dot{k}_{t-i}^p = \eta q_{t\_i}^{no} \qquad 4.4$$

Equation (4.5) identifies total government expenditure (g_t), which consists of consumption and investment spending, as in the Cox and Harvie (2010) model. However, the Libyran situation is different; total government expenditure depends positively on only two components of expenditure: government consumption spending (con_t^g) and investment spending (i_t^g). Both are assumed to be heavily dependent on oil revenue (Ali & Harvie 2013; Ahmouda 2014). Investment in education and health are considered different types of human capital investment, which contribute to improved labour

[32]Ali and Harvie (2013) showed the change in the stock of private capital ($\dot{k}_{t-i}^p$) as the increase in capital from the end of the previous period to the end of the current period and is some fraction of the divergence between the desired and actual stock of capital, in which the desired capital stock is assumed to depend upon non-oil output. No_{t-i}^s, $\dot{k}_{t-i}^p$ = $\mu(k_{t-i}^{p*} - k_{t-i}^p)$, k_{t-i}^{p*}= $a\ No_{t-i}^s$.

productivity and supply of non-oil output(i_t^{gh}). Investment in infrastructure (i_t^{gf}) can also increase productivity in the non-resource sector and boosts supply (Aschauer 1989a, b;Alimohamed 2014; Mohammazadeh 2015).

$$g_t = c_3 + \sum_{i=1}^{K} a_{32}^{i}\, con_{t-i}^{g} + \sum_{i=1}^{K} a_{33}^{i}\, i_{t-i}^{gh} + \sum_{i=1}^{K} a_{34}^{i}\, i_{t-i}^{gf} \qquad 4.5$$

The social welfare spending considered by Cox and Harvie (2010) and Mohammadzadeh (2015) is ignored in this study because the consideration of welfare expenditure by studies that use data on developed countries may be due to higher allocation for this kind of spending. For example, in Australia, about 35% of the government's total expenditure is on social security and welfare (Australian Government 2017). For Libya during 2000–2016, only 5% of total public expenditure was spent on social welfare (World Bank 2016). This percentage is not significant, so expenditure on social security and welfare is ignored in this model. In developed countries, government spending plays a vital role in the provision of public goods and services in the context of economic and social welfare, and income redistribution (Alimohamed 2014). Developing countries are still in the early stages of development, so the primary aim of government spending policies is to improve the nation by public investment in the process of economic and social development through two important channels—human capital and infrastructure (Alimohamed 2014). Thus, this model considers government consumption expenditure and investment expenditure, including human capital and infrastructure, as in Equations (4.6), (4.7) and (4.8), in which (i_t^{g}) is government investment spending (i_t^{gh}) and investment in infrastructure (i_t^{gf}). In Equation (4.9), (con_t^{g}) is government consumption spending.

The Libyan government does not use all the revenue from the oil sector to invest in human capital and infrastructure. Instead, it leaves a part for consumption expenditure as well, which only boosts demand. Therefore, a key policy decision by government is to determine the proportion of the oil revenue to be spent on infrastructure (η_1), human capital (η_2) and consumption spending ($1 - \eta_1 - \eta_2$). This study ignores the possibility of government retiring debt.

Equations (4.6), (4.7) and (4.8) show that government investment spending is equivalent to the difference between the policy-determined public capital stock (desired) and public capital stock. The amount of investment in each area is dependent on the policy-determined desired capital stock in this field, based on the proportion of oil revenue the government wants to invest in each area. It is also determined by the government's development strategy and policy priorities.

Equation (4.6) explains government gross investment (i_{t-i}^{g}), which equals the change in the stock of public capital ($\dot{k}_{t-i}^{g}$). The parameter (ɳ) shows the portion of the divergence between the desired gross stocks of capital (k_{t-i}^{g*}) and actual gross stock of capital $\left(k_{t-i}^{g}\right)$, which is gradually closed.

$$i_{t-i}^{g} = \dot{k}_{t-i}^{g} = \eta(k_{t-i}^{g*} - k_{t-i}^{g}) \qquad 4.6$$

Equations (4.7a) and (4.8a) describe development expenditure on human capital (i_{t}^{gh}) such as government spending to develop education and health systems and development expenditure on infrastructure(i_{t}^{gf}). In Libya, the public sector represents the main sponsor to develop physical capital (infrastructure), such as roads, bridges, tunnels, water supply, sewers, electrical grids, telecommunications and human capital, through free education and improved public health care (World Bank 2006, 2009). Such expenditures can enhance productivity. Government spending on investment, human capital (i_{t}^{gh}) and infrastructure (i_{t}^{gf}) is equal to the change in the capital stocks allocated to build human capital ($\dot{k}_{t-i}^{gh}$), and used to develop physical capital (infrastructure). The parameters, (ɳ$_1$) and (ɳ$_2$), show the fraction of the divergence between the desired capital stock in human capital stock $\left(k_{t-i}^{gh*}\right)$, desired physical capital stock (k_{t-i}^{gf*}) and actual capital stock in human capital stock (k_{t-i}^{gh}) and (k_{t-i}^{gf}). The policy-determined desired human capital stock (k_{t-i}^{g*}) and physical capital stock (k_{t-i}^{gf*}) are based on the proportion of oil revenue, as shown in Equations (4.7b) and (4.8b), that the government wants to allocate to human capital and infrastructure according to its priorities and development strategy.

$i_t^{gh} = \dot{k}_{t-i}^{gh} = \eta_1(k_{t-i}^{gh*} - k_{t-i}^{gh})$ 4.7a

$k_{t-i}^{gh*} = \eta_1(o_t^x + po_t + er_t)$ 4.7b

$i_t^{gf} = \dot{k}_{t-i}^{gf} = \eta_2(k_{t-i}^{gf*} - k_{t-i}^{gf})$ 4.8a

$k_{t-i}^{gf*} = \eta_2(o_t^x + po_t + er_t)$ 4.8b

Equations (4.7b) and (4.8b) show how the government allocates oil revenue between desired human capital (k_{t-i}^{gh*}) and desired physical capital stock (k_{t-i}^{gf*}). The amount of revenue from the oil sector ($o_t^x + po_t + er_t$) depends on volume of oil exports(o_t^x) and the world oil price (po_t), which is exogenously determined in international markets, and by the real exchange rate ($er_t = e_t - p_t$). Thus, this term gives the domestic currency value of these oil revenues.

In Equation (4.9), the government uses a proportion of the oil revenue for consumption expenditure, such as spending on salaries, purchases of good and services, and food subsidies (Edwik 2007). Thus, the relationship between oil revenue in local currency and government consumption spending is assumed to be positive.

Government consumption spending (con_t^g) depends on government revenue generated from the oil sector. The oil revenue is expressed through their main components: exports of oil, price of oil and real exchange rate. The real exchange rate is equal to the nominal exchange rate deflated by domestic prices $er = (e_t - p_t)$.

$con_t^g = (1 - \eta_1 - \eta_2)(o_t^x + po_t + er_t)$ 4.9

Equation (4.10) identifies the fiscal budget, which is government expenditure (g_t) minus tax revenues (T_t^x).

$bd_t = g_t - T_t^x$ 4.10

where $-bd_t = T_t^x - g_t$ represents fiscal budget deficits in case of Libya. As shown in Chapter 2, tax revenue generated from the non-oil sector represents only 5% of total tax revenue (IMF 2016).

As shown in Equation (4.11b), tax revenue generated from oil production/revenue is equal to $(o_t^a + po_t + er_t)$, where (o_t^a) is oil production, po_t is oil price, $er_t = (e_t - p_t)$ is the real exchange rate and non-oil production is (No_t^s) .

$$T_t^x = \sum_{i=1}^{K} a_{51}^i (o_{t-i}^a + po_{t-i} + er_{t-i}) + \sum_{i=1}^{K} a_{52}^i No_{t-i}^s \qquad 4.11$$

The fiscal budget must be in balance in a long-term steady state (Cox & Harvie 2010). If the budget remains in either surplus or deficit, this would affect money supply, real money balances held by the private sector, wealth and spending, and a steady state cannot be achieved.

Equation (4.12) identifies the budget deficit that occurs when government expenditure (g_t) becomes larger than tax revenues (T_t^x). The budget deficit (bd_t) can be financed in three ways: through money accommodation, bonds issued by the government (Cox & Harvie 2010) and by borrowing domestically from the private sector or from abroad (Romer 1983).

In Libya, the budget deficit is financed predominantly through money accommodation, sales of government bills and securities only to the CBL (Central Bank of Libya 2010; Libyan National Authority for Information and Documentation 2015), as there is no government bond market in Libya's rudimentary financial system. The Libyan government has not, as yet, borrowed from abroad (Ali & Harvie 2015). The role of oil exports in financing the fiscal budget is also considered. As discussed in Chapter 2, the Libyan fiscal budget has been adversely influenced by a reduction in oil exports and revenue, which began in 2011 (IMF 2013). In the post-Qaddafi period, the continued political stalemate with the decline in oil exports has hurt the public budget. Revenues from the oil sector dropped to half that before the revolution. For example, oil revenue growth declined by –54% in 2014 compared with 2010, the last year before the revolution, and the base year of this study. However, the increase in consumption spending remained high, at about 59.7% of total government spending, mainly due to the appointment of new public officials (World Bank 2016). Hence, this study assumes that foreign receipts from government-owned oil sales (revenue from oil exports) $(o_t^x + po_t + er_t)$ and money supply influence the fiscal budget of Libya (IMF 2013).

$$bd_t = c_6 + \sum_{i=1}^{K} a_{61}^i (m_{t-i}^S - p_{t-i}) + \sum_{i=1}^{K} a_{62}^i (o_{t-i}^x + po_{t-i} + er_{t-i}) \quad 4.12$$

The non-oil trade balance (NTP_t) is determined by non-oil exports (x_t^n) less non-oil imports (x_t^m). The real exchange rate is an important variable that has a significant impact on the trade balance in oil-exporting developing countries (Cushman & Zha 1997). In Equation (4.13), non-oil exports (x_t^n) depend positively on real domestic income, which is the sum of non-oil and oil production(y_t^{RI}), and the real exchange rate. Real oil output (government oil revenue) will directly affect government income and, in turn, spending. A rise in domestic income can trigger a reallocation of domestic production to address increased domestic demand, so that less is exported, more flows to the domestic market and more will be imported.

The real exchange rate is expressed by Cox and Harvie (2010) as $(e_t + p_t^n - p_t)$, where (e_t) is the nominal exchange rate,[33] (p_t^n) is the world price level, and (p_t) is the domestic price level. The current study considers the real effective exchange rate. The impact of the effective real exchange rate includes the impacts of the real exchange rate and the non-oil imported price index (p_t^n), as measured by the IMF (2013). This assumption is based on a finding from previous studies, which use Libyan data to examine the impact of oil price shocks and/or oil exports on macro-economic factors such as economic growth (Edwik 2007; Ahmouda 2014; Ali & Harvie 2013). These studies concluded that an appreciation of the real exchange rate and its Dutch disease implications might be the main reason for lower non-oil output and exports in Libya (Edwik 2007; Ali & Harvie 2013; Ahmouda 2014). In Libya, the exchange rate

.[33] In the case of Libya, this is the number of units of the domestic currency (LYD) to one unit of the foreign currency (US$) (World Bank 2016; Central Bank of Libya 2016).

appreciation leads to an increase in imported products due to their reduced price in the international market (Ali 2011).

$$x_t^n = c_7 + a_{71}^0(e_t + p_t^n - p_t) + \sum_{i=1}^{K} a_{72}^i y_{t-i}^{RI} \quad 4.13$$

Equation (4.14) shows that total non-oil imports are disaggregated into non-oil consumption imports (m_t^{con}) and non-oil capital imports (i_t^{mcap}).

$$m_t^n = m_t^{con} + i_t^{mcap} \quad 4.14$$

Equation (4.15) identifies the consumption of non-oil imports, which depends positively upon the real effective exchange rate ($e_t + p_t^n - p_t$) and positively on domestic real income (y_t^{RI}). In this equation, the exchange rate is assumed to have a contemporaneous impact. This is because the nominal exchange rate is a policy variable in this study and its response should be instantaneous so it is expressed as shown in Equations 4.13 and 4.15 (Afandi 2005; Hililan 2013).

$$m_t^{con} = c_8 + a_{81}^0(e_t + p_t^n - p_t) + \sum_{i=1}^{K} a_{82}^i y_{t-i}^{RI} \quad 4.15$$

It is assumed in Libya that capital imports are determined by the adjustment of actual imported capital spending to its policy specified level (Ali 2011). Thus, capital imports can be expressed as in Equation (4.16), where government investment expenditure on capital imports is equivalent to the difference between the policy-determined imported capital stock (desired) (k_{t-i}^{mcap*}) relative to that of the actual imported capital stock $\left(k_{t-i}^{mcap}\right)$.

$$i_t^{mcap} = \dot{k}_{t-i}^{mcap} = \eta_4(k_{t-i}^{mcap*} - k_{t-i}^{mcap}) \quad 4.16$$

Real income positively depends upon real non-oil income (No_t^s), and real oil income ($o_t^x + po_t + er_t$) and on the international competitiveness of non-oil goods (see Equation 4.17).

$$y_t^{RI} = c_9 + \sum_{i=1}^{K} a_{91}^i No_{t-i}^s + \sum_{i=1}^{K} a_{92}^i (o_{t-i}^x + po_{t-i} + er_{t-i}) + \sum_{i=1}^{K} a_{93}^i (e_{t-i} + p_{t-i}^n - p_{t-i}) \qquad 4.17$$

4.3.1.2 Asset market and monetary policy

Cox and Harvie's (2010) model includes four financial assets: domestic money, domestic bonds, foreign bonds and equities. In Libya, domestic money represents the most critical asset (Ali 2011; Masoud 2013) since Libyan financial markets are underdeveloped (Ali 2011; African Development Bank 2012) and are still in the process of liberalisation (Edweib et al. 2013). Thus, this study will only focus on modelling the money market and its equilibrium.

In traditional money market equilibrium, demand for real money balances (M_t^d) depends positively on real income, proxied by non-oil supply and negatively on the nominal interest rate, with the latter being a measure of the opportunity cost of holding real money balances (Cox & Harvie 2010; Usui 1996; Kim & Roubini 2000; Suranovic 2010). In developing countries, the interest rate is no longer a good proxy for the cost of holding money. Indeed, the interest rate is subject to regulation by policymakers, and tends to show the restrictiveness of monetary policy (Masoud 2013; Afandi 2005; Nguyen 2014). Therefore, the inflation rate should be utilised instead of the interest rate (Usui 1996). Inflation has a significant adverse influence on money demand and better shows the opportunity cost of holding money (Ali 2011). For this reason, demand for real money balances, Equation (4.18), is expressed as:

$$M_t^d = c_{10} - \sum_{i=1}^{K} a_{101}^i \pi_{t-i} - \sum_{i=1}^{K} a_{102}^i r_{t-i} + \sum_{i=1}^{K} a_{103}^i No_{t-i}^s \qquad 4.18$$

The demand for real money balances in Equation (4.18) is positively correlated to real non-oil output, representing a transactions demand. This is because demand money from the private sector is generated by the non-oil sector, but negatively correlated to the domestic interest rate (r) and domestic inflation (π_t).

The growth rate of nominal money supply in Equation (4.19) depends on the growth rate of domestic credit expansion (dc_t) assumed to be exogenous and equal to zero, [34] the growth rate of the stock of foreign assets (f_t) which is assumed endogenous and accumulated through the balance of payments (see Harvie & Thaha 1994), and growth in the money supply arising from borrowing to fund the budget deficit through the central bank.

$$\dot{M}^{S}_{t-i} = c_{11} + \sum_{i=1}^{K} a^{i}_{111}\dot{d}c_{t-i} + \sum_{i=1}^{K} a^{i}_{112}\dot{f}_{t-i} + \sum_{i=1}^{K} a^{i}_{113}\dot{b}d_{t-i} \qquad 4.19$$

This study assumes two monetary policy relationships that react to Dutch disease effects. The first is uncovered interest rate parity (UIRP).

4.3.1.2.1 Uncovered interest rate parity (UIRP)

Uncovered interest rate parity (UIRP) is a key short run relationship in international financial markets between relative interest rates and the exchange rate. It requires the differential between the nominal interest rates between two countries is equal to the expected change in the exchange rate (Hilde 2009). According to Lily and Kogid (2011), this provides the theoretical rationale for changing the domestic interest rate to influence the exchange rate. They define the uncovered interest rate parity condition as:

$$(r_t - r^{*}_{t}) = (e_t{}^{f} - e_t) + \varepsilon_t \qquad 4.20$$

Where r_t and r^{*}_{t} are the nominal domestic and foreign interest rates respectively, e_t is the nominal exchange rate, $e_t{}^{f}$ is the expected exchange rate and ε_t is a stochastic residual. When the domestic interest rate is higher than the foreign interest rate, that is, the interest rate differential is positive, then there will be an expected depreciation in the exchange rate (Gumus 2002). This expected depreciation is shown by the expected rate

[34] Following Ali and Harvie (2013).

being greater than the spot exchange rate (Furman & Stiglitz 1998). Therefore, a higher domestic interest rate relative to the rate overseas induces capital inflow, which appreciates the spot exchange rate. The relationship between the interest rate differential and the exchange rate should be a negative so that tightening monetary can result in an immediate exchange rate overshooting (Wilson 2009). However, this sets up an anticipated depreciation when the funds need to be paid back overseas. The benefit of the capital inflow will be balanced by the expected foreign exchange loss according to the uncovered interest rate parity condition (4.20).

4.3.1.2.2 Taylor rule monetary policy.

Since 1993, the so-called Taylor rule and its various extensions have become the primary method used to analyse a central bank's reaction function and introduce monetary policy into macro-economic models for developed countries (Asso et al. 2007). The central bank adjusts the interest rate to stabilise both output and inflation (Bernanke et al. 2005; Hodge et al. 2008).

A Taylor rule shows the reaction of the nominal interest rate, as set by the central bank, to changes in inflation, output or other economic conditions (Taylor 1993; Henderson & McKibbin 1993). In particular, the rule describes how, for each 1% increase in inflation, and/or output, the central bank tends to raise the nominal interest rate by more than one percentage point to maintain inflation and output at, or close to, a predetermined targeted rate or level (Taylor 1993; Henderson & McKibbin 1993). Thus, this rule can be used as a proxy for the CBL to set the nominal interest rate. In this context, this model includes two Taylor rule versions. The original version, which includes the interest rate or its proxy variable, money growth, is where there is no effect on the exchange rate as introduced by Taylor (1993) and Henderson & McKibbin (1993) based on a closed economy mode (see Equations 4.21 and 4.22).

$$r_t = r_{\mathrm{t}}^{\mathrm{g}} + \Omega_1\left(y_t^{RI} - \mathrm{y}_{\mathrm{t}}^{\mathrm{g}}\right) + \Omega_2\left(\pi_{\mathrm{t}} - \pi_{\mathrm{t}}^{\mathrm{g}}\right) \qquad 4.21$$

This was modified by Henderson and McKibbin (1993):

$$r_t - r_t^g = \Omega_1 \left(y_t^{RI} - y_t^g \right) + \Omega_2 (\pi_t - \pi_t^g) \quad 4.22$$

where $(r_t - r_t^g)$ shows deviations of the short-term nominal interest rate (r_t) from some baseline value (r_t^g) in response to deviations in output $(y_t^{RI} - y_t^g)$ and inflation $(\pi_t - \pi_t^g)$ from their targeted values (y_t^g) and (π_t^g) respectively, as set by the central bank. The parameters Ω_1 and Ω_2 reflect the relative importance placed by the central bank on the deviations of the target variables from their target values.

Importantly, the response of monetary policy needs to be modelled via a Taylor rule for the small and open economy. Equation (4.23) represents the use of two monetary policy instruments, the interest rate and exchange rate that can be used to stabilise inflation and output. If real output and/or inflation fall below their target levels, the policymaker needs to decrease the interest rate (r_t) and/or depreciate the nominal exchange rate (e_t). The parameter (α) represents the relative weight of the interest rate instrument and $(1 - \alpha)$ is the corresponding weight for the exchange rate instrument applied in the operation of monetary policy.

$$\alpha r_t + (1 - \alpha) e_t = \Omega_1 \left(y_t^{RI} - y_t^g \right) + \Omega_2 (\pi_t - \pi_t^g) \quad 4.23$$

As mentioned previously, monetary policy affects the oil sector through the domestic interest rate and the exchange rate. An analysis of both the exchange and interest rate effects is required because Libya is an open economy. In the case of Libya, this analysis must also consider the interdependence of the domestic monetary policy instrument variable and the nominal exchange rate, along with fiscal policy and an oil price shock (see Chapter 2). Consequently, this section extends the Taylor rule proposed by Balabay (2011) (see Chapter 3) to include oil price shocks and fiscal policy using the government spending effect. The current study proposes a Taylor rule for the Libyan economy, as shown in Equation 4.24:

$$\lambda_0 r_t - (1 - \lambda_0)\, e_t = \rho r_{t-1} + \alpha (\dot{No}_t^s - \dot{No}_t^{s^*}) + \beta (\pi_t - \pi^*) + \lambda_1\, e_{t-1} + \gamma \dot{po}_t + \delta \dot{g}_t + \varepsilon_t \quad 4.24$$

This amalgam of Taylor rules will be used to investigate how the nominal interest rate and exchange rate respond to deviations in both real non-oil GDP growth and the inflation rate from their targets. Importantly, the rule also includes potential direct effects of an oil price shock and government spending. The parameters α , β and γ indicate their respective effects and weights on the instruments, and the responses required to counter a world oil price shock and subsequent Dutch disease and inflationary effects.

The left side is the monetary condition index (MCI), which sets the responses of both instruments, with λ_0 indicating their relative weights. The exchange rate has a negative sign because an increase in a right side variable above target requires an appreciation, shown as a reduction in e_t (and/or an increase in the interest rate r_t). The exchange rate movement is a critical transmission channel for open economies, according to Dungy and Fry (2009) and Kempa and Wilde (2011). Using the MCI with inflation and exchange rate movements in the Taylor rule provides a sound reference for monetary policy decisions. The lagged value of the interest rate, indicating the smoothing preference of the central bank, is excluded by setting $\rho = 0$. So is the lagged value of the exchange rate, with $\lambda_1 = 0$, indicating no exchange rate pass through to inflation. The removal of these lags is required in the contemporaneous specification of the A_0 matrix for SVAR, although their importance can be determined from VAR estimates. The additional term added to the right side of the Taylor rule is the rate of growth in total real government spending. Given the importance of fiscal spending detected previously in this chapter, it is interesting to determine if it should be a determinant of monetary policy. The estimate of the parameter δ will indicate the relative importance of the fiscal policy stance in affecting the monetary policy instruments (see Section 7.4.1). Based on the available literature, it appears that this analysis has not been undertaken previously.

4.3.1.3 Domestic price and wage inflation

Equations (4.25) to (4.26) identify domestic prices and wages and the external balance of payments equation. The model uses core inflation, so domestic price inflation and wage inflation are included. Domestic prices are based on the models of Cox and Harvie (2010), Ali and Harvie (2013) and Mohammadzadeh (2015). The domestic price level (p_t) is a weighted average of the domestic nominal wage (w_t), the domestic currency price of oil $(e_t + po_t)$ and the domestic currency price of imported non-oil goods $(e_t + p_t^n)$, which is represented by the imported goods price index in foreign currency multiplied by the exchange rate:

$$p_t = c_{13} + \sum_{i=1}^{K} a_{131}^{i} w_t + \sum_{i=1}^{K} a_{132}^{i} (e_t + po_t) + \sum_{i=1}^{K} a_{133}^{i} (e_t + p_t^n) \qquad 4.25$$

Equation (4.26) illustrates the new Keynesian Phillips curve, which specifies that nominal wage growth depends on the non-resource output gap (No_t^{gap}), defined as the excess of non-resource output demand relative to its supply $\left(No_t^d - No_t^s\right)$ (the stock of non-oil output is used as the proxy variable for this term), inflationary expectations(π_t^e) and the impact of oil price shocks (po_t).

$$w_t^r = c_{14} + \sum_{i=1}^{K} a_{141}^{i} No_t^d - No_t^s + \sum_{i=1}^{K} a_{142}^{i} \pi_t^e + \sum_{i=1}^{K} a_{143}^{i} po_t \qquad 4.26$$

Most developing countries depend on oil as an input to operate their industrial and non-industrial sectors. Libya is no exception. Therefore, increases in oil prices can increase production costs, including the wage rate (Loungani 1986; Ahmad 2013). This study will not model production costs; it only attempts to explore how the rate of change of oil prices can influence wage inflation in Libya, based on the concept of the new Keynesian Phillips curve. The increased wage rate addresses the causes and consequences of inflation, which is most popular in Keynesian economic theory and known as the 'cost-push' origin of inflation. The wage-price spiral suggests that rising wages increases disposable income, thereby raising demand for goods and causing prices to rise. Rising prices create demand for higher wages, which leads to higher production costs and further upward pressure on prices (Blanchard 1986; Kandil 2003). Money supply is assumed to be continuously increased to facilitate higher nominal wages and prices in Libya (see Chapter 2), which shows that the greatest wage push is likely to come from public sector workers who are in more secure and influential positions in Libya.

4.3.1.4 The external sector

As discussed previously, changes in foreign assets held domestically is equal to the current account balance, which depends on the trade balance, interest income from foreign assets, net oil exports and the real exchange rate, which has a negative impact on non-oil sector exports (Cox & Harvie 2010; Mohammadzadeh 2015). To achieve a long-term steady state, the current account must be in balance, otherwise wealth effects arising from the accumulation of foreign assets will generate further macro-economic adjustments, such as increased demand for non-oil output (Cox & Harvie 2010; Mohammadzadeh 2015).

Hence, the balance of payments (BP_t) in Equation (4.27) includes both current and financial (capital) accounts. The current account consists of the trade balance, which is the sum of the balance of non-oil trade and the balance of oil trade (NTP_{t-i} and OTP_{t-i}), where changes in foreign asset holdings are determined by the country's current account balance. The financial account involves foreign interest income ($r_t^* f$). Foreign interest income flows are recorded in the current account under 'net interest income'. Therefore, for the model to achieve equilibrium, the current account balance must be zero in a steady state by implication, so must the BoP balance.

$$BP_{t=} c_{15} + \sum_{i=1}^{K} a_{151}^{i} (NTP_{t-i}) + \sum_{i=1}^{K} a_{152}^{i} r_t^* f + \sum_{i=1}^{K} a_{153}^{i} (OTP_{t-i}) \qquad 4.27$$

The real trade balance in Equation (4.28) depends positively on the oil price (po_t) and oil exports (o_t^x), negatively on the real effective exchange rate ($e_t + p_t^n - p_t$) and positively on the non-oil trade *balance* ($No_t^x - No_t^m$).

Net oil exports are assumed to be exogenously determined, being based on world oil prices and government policy relating to the quantity of oil exported. Government policy determines how much oil is exported and how much is retained for domestic use. Oil exports in this equation increase following an oil boom (from positive oil price shocks) and create a current account effect (through increased trade value), as discussed in Chapter 3. The current account equation based on Cox and Harvie's (2010) model is shown in Equation (4.29). The current account depends positively on the oil price (po_t) and oil exports (o_t^x), positively on the non-oil trade $balance$ ($No_t^x - No_t^m$), positively on foreign interest income ($r_t^* f$), and negatively on the real effective exchange rate ($Ere_t = (e_t + p_t^n - p_t\ )$. An increase in the surplus on oil and non-oil trade is assumed to have a positive impact on the correct account. It is also assumed that an increase in foreign interest income contributes positively to the current account.

$$TRB_t = c_{16} + \sum_{i=1}^{K} a_{161}^{i}\, po_t + \sum_{i=1}^{K} a_{162}^{i}\ o_t^x - \sum_{i=1}^{K} a_{163}^{i}\ Eer_t + \sum_{i=1}^{K} a_{164}^{i}\ (No_t^x - No_t^m) \qquad 4.28$$

$$CA_t\ = c_{16} + \sum_{i=1}^{K} a_{161}^{i}\, po_t + \sum_{i=1}^{K} a_{162}^{i}\ o_t^x - \sum_{i=1}^{K} a_{163}^{i}\ Eer_t + \sum_{i=1}^{K} a_{164}^{i}\ (No_t^x - No_t^m) + \sum_{i=1}^{K} a_{165}^{i}\ r_t^* f \qquad 4.29$$

As mentioned previously, this study will adopt the SVAR approach to estimate the equations of the model and conduct exogenous shock and policy simulations. Section 4.4 will justify the use of the SVAR method for this study, as well as the theoretical background of this modelling approach.

4.4 The SVAR Methodology

The empirical literature reviewed in Chapter 3 displayed two main methods: VAR and SVAR. These methods are most relevant for this study. SVAR is a superior modelling approach derived from the traditional VAR model. It will be used to estimate the equations of the model using Libyan data and conduct the policy and exogenous shock simulation analysis relevant to this study. The SVAR model can determine parameters and show reactions to structural shocks (simultaneous analysis interaction among variables of the model) (Nguyen 2014). The simulation analyses are necessary to measure the response of macro-economic variables to external shocks.

This section presents the justification for using SVAR—the difference between recursive and non-recursive SVAR—background to short- and long-term specifications (theoretical framework of modelling SVAR) and arguments about stationary and non-stationary data.

4.4.1 Definition and justification of using SVAR

There are several reasons to adopt the SVAR model over other methods in this study. Both VAR and SVAR can show the response of an endogenous variable to lagged changes in other endogenous variables in the system, including the lag itself. This means the VAR system shows the dynamic response of an endogenous variable to changes in other variables in the model. SVAR also illustrates the reaction of endogenous variables to shocks in exogenous variables contemporaneously and in lags. Therefore, the response of endogenous variables to external shocks can be displayed by the functions of this method (Kim & Roubini 2000). This study considers both dynamic and contemporaneous responses of endogenous variables to external shocks. Hence, the study uses the advantages of both VAR and SVAR (see Chapter 5). However, the simulation will be employed through a SVAR matrix for several reasons.

The SVAR method has two useful tools of analysis: the impulse response function (IRF) and variance decomposition (VD), which shows the forecast outcomes on endogenous variables like real GDP and inflation to external shocks in the short and long run, arising from policy and exogenous shocks (Afandi 2005; Us 2004). This addresses the concerns of macro-economic policymakers interested in how changes in macro-economic policies affect key macro-economic variables under various policy scenarios.

The VAR method investigates dynamic interactions between the variables and uses impulse responses and forecast error VDs for this purpose. However, the VAR model that measures the response of domestic variables to shocks or innovations cannot check *a priori* theoretical assumptions of statistical tools. Therefore, SVAR models have been created as a structure fusing identifying restrictions for the developments to be followed in a drive and impulse response analysis (Lütkepohl 2006). The significance and validity of imposed relationships among variables can be tested through likelihood tests in the SVAR system (Zaidi 2011). Hence, the relationships among variables in a SVAR model must be developed based on related economic theories (Liu & Jansen 2013). This makes the SVAR approach more powerful than VAR to investigate the response of domestic variables to exogenous shocks.

In this regard, the SVAR model constrains a vast number of lags provided by the VAR. Concern over the considerable number of lags in the VAR method is addressed by imposing restrictions on the relationship between variables (Dungey & Pagan 2000). This means that SVAR models can reduce the number of parameters and structural equations by imposing restrictions to facilitate the interpretation of results. These restrictions should be based on both relevant theories and successful empirical studies (Dungey & Pagan 2000).

In the VAR method, each variable is related to all lags of other variables in the system without contemporaneous interactions. This issue is raised in the literature, and there is an emphasis on resolving this problem (Liu & Jansen 2013). It also suffers from the curse of dimensionality. This, and the desire to preserve degrees of freedom, leads to VARs with relatively small numbers of included variables. In contrast, central banks are thought to monitor and analyse a large number of data series, and to consider the information contained in these series when making decisions. Thus, there is a potential problem of missing information with traditional VAR, and the 'identified monetary shocks' from these models could be subject to measurement error. Recent research has combined the VAR approach and factor analysis in a so-called SVAR model to overcome this missing information problem (see for example Romer & Romer 2010; Boivin 2006; Boivin et al. 2009; Sims & Zha 2006; Liu & Dennis Jansen 2013, p.2511). SVAR allows for contemporaneous interaction between variables with a specific number of lags, which can enter each structural equation by imposing restrictions on some relationships between variables in a matrix form, using theory to establish these links (Dungey & Pagan 2000). The objective of building the SVAR model with such restrictions on the interactions and dynamics among variables is to obtain plausible responses simultaneously occurring in the short and long run (Dungey & Pagan 2000).

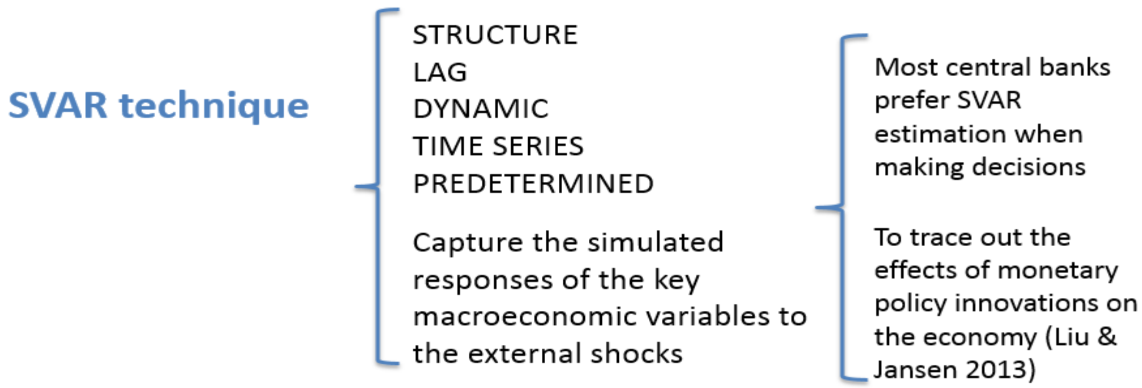
The SVAR method, as a structural equation system, can permit analysis of dynamic influences on all variables of interest (Brooks 2014). Further, since SVAR focuses on a set of key macro-economic variables and it is not a large-scale model, its analysis can provide a more realistic and tractable policy resolution. It can show clearly the relationships between key macro-economic variables such as inflation, unemployment and real GDP and policies, such as the interest and exchange rates in different periods (Leeper et al.

1996). Thus, the policymaker can determine which is the best policy to provide good outcomes for key macro-economic variables using a SVAR simulation (Afandi 2005).

Moreover, SVAR can focus on critical variables. These critical variables can be used either for analysis of the determination of appropriate policy or for investigation of economic performance. Further, SVAR can operate by imposing a few restrictions, which are different from other dynamic models such as the TRYM model and MM2 method. Models (e.g., TRYM) impose strong restrictions on the data, which are not often examined for their validity. Therefore, assumptions such as rational expectations and uncovered interest parity are generally invoked, while simple dynamics are assumed in the structural equations. Consequently, because features such as UIRP and rational expectations impose restrictions on dynamics in models such as TRYM, a SVAR model places few restrictions on the dynamics (Dungey & Pagan 2000, p.322; see Hansen & Sargent 1983 and King *et al.* 1988, 1991 for more information).

This advantage allows the researcher to assume a large variety of hypotheses and to form expectations in the form of a dynamic system by applying different weights to the estimated variables (Dungey & Pagan 2000). Figure 4.1 summarises the main features of the SVAR method compiled by this study based on existing literature (Dungey & Pagan 2000; Afandi 2005; Hem et al. 2015; Cologni & Manera 2008; Amano & Norden 1998; Farzanegan & Markwardt 2009; Ahmed & Wadud 2011; Liu & Jansen 2013).

Figure 4.1. Main features of the SVAR approach.



Source: Dungey and Pagan (2000); Afandi (2005); Hem et al. (2015); Cologni and Manera (2008); Amano and Norden (1998, 2003); Farzanega and Markwardt (2009); Ahmed and Wadud (2011).

The above discussion explains why there has been extensive interest in using the SVAR approach in many macro-economic studies that use time series data (Dungey & Pagan 2000). In particular, SVAR has been employed widely in monetary policy studies (Afandi 2005; Kim & Roubini 2000; Hililian 2013; Liu & Jansen 2013; Nguyen 2014) to estimate the effects of monetary policy instruments and external shocks, such as US federal fund rate shocks, on key macro-economic variables such as GDP and inflation (Kim & Roubini 2002; Nguyen 2014). In addition to fruitful use of the SVAR and its capacity to provide accurate information on monetary policy analysis and its related shocks (Afandi 2005; Kim & Roubini 2000; Hililian 2013; Liu & Jansen 2013; Nguyen 2014), it has also been used for fiscal policy analysis (see Blanchard & Perotti 2002; Perotti 2007; Kim & Roubini 2008; Alkahtani 2013), which supports its use in the current study. It is an effective tool to estimate fiscal policy effects and related shocks, such as government spending and net taxes on the performance of economic activities and the improvement of GDP (Alkahtani 2013).

Blanchard and Perotti[35](2002) argued that the SVAR model is an appropriate approach for fiscal policy analysis that illustrates fiscal policy shocks and their impact on economic activity (such as GDP) for two reasons. First, according to Keynesian fiscal policy, fiscal variable movements are based on tax and spending decisions set for specific targets, and not to stabilise output (the target of monetary policy) (Alkahtani 2013; Taylor

[35] Blanchard and Perotti (2002) used SVAR to determine the effects of government spending and net taxes shocks on economic activity (using real GDP in log form, and in per capita terms as a proxy for economic activity) for postwar US data: 1960–1997 (Alkahtani 2013).

& Williams 2010). Nevertheless, fiscal shocks have an impact on GDP movements (Blanchard & Perotti 2002). This is because the usual lag implementation of fiscal policy through legislation delays results in a weak or no discretionary response of current fiscal policy to the unexpected instantaneous volatility of economic activity within a specific period. Conversely, monetary policy is more responsive to the movements of the GDP. This suggests there should be fiscal policy shocks following GDP movements; these can be identified after the automatic effects (Alkahtani 2013,p.23) and are demonstrable through the use of SVAR. Second, fiscal shocks, such as increased government spending for development due to increased government revenue, can encourage investment, which enhances GDP (Alkahtani 2013; Ali & Harvie 2013, 2017).

Kim and Roubini (2008) provided further evidence of the efficacy of this method. They used SVAR to investigate the effects of fiscal policy (government budget deficit shocks) on the current account and real exchange rate, during a flexible exchange rate regime using US data from 1973–2004. They discovered that SVAR provides more realistic results for US fiscal policy than traditional methods such as VAR. Their analysis demonstrated that an expansionary fiscal policy shock had a positive effect on the current account and depreciated the real exchange rate. Improvements to the current account were largely attributable to increases in private savings and decreases in investment. Depreciation of the nominal exchange rate, not the relative price level change, was posited as an important reason for the depreciation of the real exchange rate. Kim and Roubini (2008) also mentioned that output shocks prevailed over fiscal shocks as the main reason for co-movements in the current account and fiscal balances. Such findings provide sound guidance for pragmatic policy development. The 'twin divergence' of fiscal balances and current account balances in this study is also explained by the prevalence of an output stock (Kim & Roubini 2008). All these results have been achieved for both fiscal and monetary policy analysis via SVAR.

Despite this, most studies examining the effects of monetary and fiscal policies concentrated on developed economies, with little attention paid to developing countries (Perotti et al. 2007). In particular, investigations in the context of MENA (Alkahtani 2013) to estimate Dutch disease and its effect on macro-economic factors using SVAR is still in its infancy[36]. To fill this gap, this study will apply the SVAR approach in the context of MENA broadly and Libya specifically to investigate Dutch disease effects and macro-economic policies. These are important contributions and have added weight to this fledgling method. Section 4.4.2 explains the identification scheme of SVAR modelling.

4.4.2 Identification scheme of SVAR modelling

To construct the structural matrix, imposed restrictions in the short and long term are considered to identify the model. These restrictions are usually in terms of zero exclusions, which reduce the contemporaneous effects between the selected variables. Sufficient restrictions are required to obtain the unobserved structural parameters in the SVAR from the reduced form VAR estimates. This will be further explained in Chapter 5. The recursive model explains that the causation among variables is unidirectional; thus, the different disturbance terms (residuals) are uncorrelated (Nguyen 2014). For this reason, the structural matrix of a recursive model is shown as a lower-triangular matrix (Kim & Roubini 2000). Conversely, in the non-recursive model, there is uni-directional (reciprocal) causation among the variables in which the residuals are correlated (Nguyen, 2014). In the literature, there is extensive and in-depth discussion about the use of the recursive and non-recursive forms of the SVAR approach. This will be further discussed in Section 4.4.3.

4.4.3 The recursive, and non-recursive form of the SVAR approach.

The literature shows that the application of the recursive form is appropriate for large, closed economies, in which the policy response to shocks is predetermined. A series of studies by Sims (1980), Christiano and Eichenbaum (1992) and Kim (1999) used the recursive approach to investigate the influence of key macro-economic variables to shocks, such as monetary policy shocks, and how the central bank responded. The application of the recursive approach is justified for several reasons. The effect of external variables on the domestic economy is small and monetary policy is primarily operated by changes in interest rates, not the exchange rate. For example, Sims (1980) used the

[36] Some recent studies of Dutch disease (Charnavoki & Dolado 2014; Bjornland & Thorsrud 2014; Issaoui 2013) have used the SVAR model.

recursive SVAR form for policy examination. Sims explained that this approach allows an orthogonal relationship between monetary policy shocks and macro-economic variables, in which the policy shock occurs and the macro-economic variables (such as consumer price index and real output) have a lagged response (Christiano et al. 1998, cited in Afandi 2005).

However, the application of the recursive method to open economies is plagued by a set of puzzling results that consist of liquidity, price and exchange rate puzzles (Leeper & Gordon 1997; Sims 1992; Hililian 2013). The recursive approach is not valid for a small, open economy in which central banks contemporaneously respond to changes in exchange rates and other foreign variables (Bhuiyan 2008; Hililan 2013).

To identify realistic results, Cushman and Zha (1997) and Kim and Roubini (2000) extended the SVAR model for a small, open economy using a non-recursive form of the SVAR. This SVAR allowed simultaneous interactions among policy variables and other macro-economic variables including endogenous and exogenous variables under a set of restrictions. Cushman and Zha's (1997) model involved the impact of exogenous variables, such as a federal interest rate shock on the Canadian economy under a flexible exchange rate. The results showed that the policy reaction to an external shock is contemporaneous.

In Libya, interest rates are less likely to be affected by external shocks due to the lack of developed bond and money markets. The review in Chapter 2 showed that the authorities were unresponsive to shocks in terms of using interest rates and exchange rate adjustments. In this sense, Libya has effectively acted as a closed economy, despite the reliance on oil exports and revenue. It is also a small economy and so a recursive specification of the SVAR may be more likely to be appropriate. Identification of the SVAR using zero restrictions will also eliminate some contemporaneous effects among the variables, again reflecting the lagged responses of private and public sector agents.

4.4.4 Stationarity and non-stationarity issues and appropriate data forms for SVAR

The reasonable reactions among variables should be based mainly on a number of restrictions on the SVAR matrix, such as existing theory and the appropriateness of making assumptions about the relationships (Berkelmans 2005; Aslanidi 2007 cited in Nguyen 2014). Therefore, this argument allows the model to run with non-stationary data for three reasons. First, transforming data into stationary variables and using first differences results in a loss of information in both the short and long term. This affects simulation results (Kim & Roubini 2000; Afandi 2005). Second, the primary objective of SVAR estimation is to investigate the mutual relationships among variables more than parameters; thus, the existence of non-stationary variables is not relevant since there will be no statistical inferences (Kim & Roubini 2000). According to Sims et al. (1990), Kim and Roubini (2000) and Nguyen (2014), the important focus of SVAR estimation is whether the estimates have standard distributions, and not about being integrated in the regressors, since the study will not test for cointegration among variables. In most of the cases, the statistics have distributions that are not affected by the non-stationarity of the data, so the estimation can be run without testing for stationarity. Third, the inclusion of lags in the SVAR model can remove the non-stationary effects among variables and make the residuals stationary (Nguyen 2014). Moreover, the use of the first differences approach leads to very large forecast horizons that require cautious interpretation of the variance of decomposition results (Zaidi & Fisher 2010).

Various methods of imposing long-run restrictions on VECM have been developed by Sims (1980), Johansen (1988), King et al. (1991), Eichenbaum and Evans (1995), and Jang and Ogaki (2003). However, it is argued that imposing identifying restrictions on cointegrating vectors can be complicated and inconsistent with some long-term restrictions a researcher may wish to impose to identify the impact of shocks (Jang & Ogaki 2003). Further, there is only one advantage of the cointegrated VAR introduced by Johansen (1988). In a system with some non-stationary estimators that are transferred to stationary through a difference approach, estimators from the IRFs from a cointegrated VAR are more precise than those estimates from levels VAR (Johansen 1988). However, this was solved in the levels SVAR estimations by imposing sufficient restrictions so that the impulse response can provide more accurate results (Kim & Roubini 2000). Also, while it is possible to implement short-run restrictions to identify shocks in the levels VAR system (Jang & Ogaki 2003), it is possible to impose long- and short-run restrictions simultaneously in the SVAR (Kim & Roubini 2000; Afandi 2005; Nguyen 2014). An important advantage of the SVAR levels is that it often produces consistent parameter estimates irrespective of whether the time series are integrated. SVAR levels are more robust than the cointegrated VAR model because it can be applied to systems with non-stationary problems. Thus, it is widely used in studies that rely on IRFs (Afandi 2005).

4.5 Conclusion

The core aim of this chapter has been to explain the theoretical model that will be used as the basis for the empirical analysis in this study. The focus of the study is the oil-exporting, developing economy of Libya. It will explore the role of oil price shocks and their impact on key macro-economic variables and macro-economic policy responses. Since, this study uses the SVAR method, which requires building the SVAR matrix factors relationships on the basis of a theoretical model, explaining the theoretical model underlying the factors relationships is essential.

The SVAR dynamic macro-economic model constructed to characterise the Libyan economy will enable analysis of the use of both fiscal and monetary policies (Taylor rules) to address the adverse effects of Dutch disease under different exchange rate regimes. This is one of the main extensions of this study to the original model of Cox and Harvie (2010). This uniqueness is essential for the goal of the current study, as it qualifies the model to explain the macro-economic dynamics arising from macro-economic policies responding to Dutch disease, unlike treating it only through fiscal policy, which has been the traditional approach.

There are two subsequent paths of this study. First, it will test for the existence of Dutch disease in Libya (see Chapter 5). Second, it will investigate the response of fiscal policy to Dutch disease under a managed exchange rate (see Chapter 6) and examine the response of monetary policy to Dutch disease under a managed exchange rate (see Chapter 6). Chapter 7 will analyse three alternative options to address Dutch disease in the Libyan context. The first shows the fiscal policy response to Dutch disease under a flexible exchange rate with two different scenarios of government consumption and investment spending. The second option includes both fiscal and monetary policy responses under a flexible exchange rate. The third option involves both fiscal and monetary policy reactions under a flexible exchange rate using a Taylor rule for a small, open, oil-exporting economy.

The next chapter will address the question of whether Libya demonstrates real symptoms of Dutch disease.

Chapter 5: Modeling the Dutch Disease

5.1 Introduction

As previously noted, an abundance of natural resources in a country, particularly in those that rely heavily on oil production and oil exports, can lead to greater macro-economic instability and lower long-term economic growth (Sachs & Warner 1995). However, economists such as Spilimbergo (1999), Kronenberg (2004), Papyrakis and Gerlagh (2004) and Stijns (2005) have expressed doubts about this, claiming that natural resource-rich countries do not unavoidably suffer from Dutch disease. However, there are some indicators of the possible existence of Dutch disease in MENA countries. These include de-industrialisation of the non-oil sector, lower economic growth and higher inflation, which are generated by real exchange rate appreciation due to foreign exchange inflows from higher oil export revenue. Surprisingly, there are few studies with strong empirical foundations employing a longer time series that investigate Dutch disease in MENA economies. Adding to this lack of understanding is the paucity of recent studies, especially any published after the 'Arab Spring', 2011. The impacts of oil price shocks and real exchange rate appreciation on key macro-economic factors remain unexamined in the literature (Emami & Adibpour 2012; Basnet et al. 2015; Omolade & Ngalawa 2017).

This chapter analyses the effects of a shock to the world oil price on macro-economic variables of the Libyan economy. The methodology adopted for this exploration initially focuses on key variables, such as the real exchange rate, real GDP, real non-oil GDP and the domestic price level using data from 1980–2016. The analysis starts with a qualitative review of these variables to detect any evidence of Dutch disease. Section 5.3 econometrically pre-tests the variables to determine SVAR is the best estimation and simulation method. According to this evidence and the previous discussions in Chapters 3 and 4, the SVAR procedure is preferred to best capture the important dynamics. Two models are estimated and tested in Section 5.4 and Section 5.5 conducts simulations. A summary and conclusions are provided in Section 5.6.

5.2 Qualitative Review of Dutch Disease Symptoms in the Libyan Economy

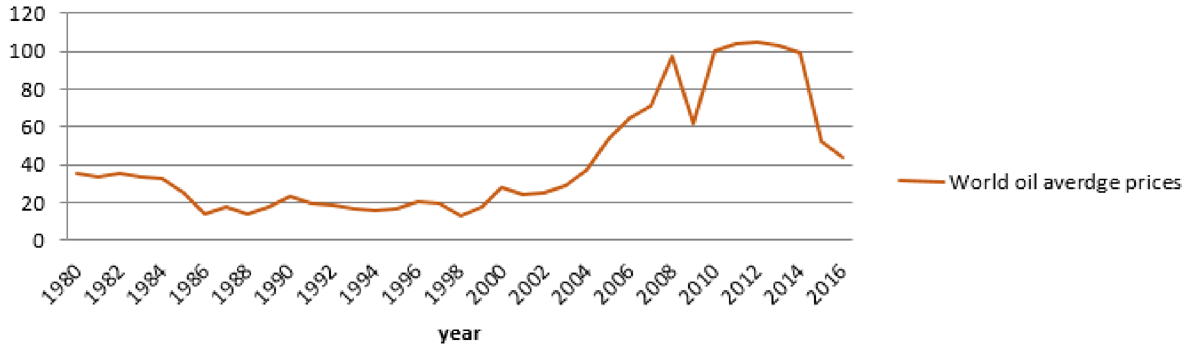
The literature review in Chapter 3 focuses on theoretical studies (Égert & Leonard 2008; Wijnbergen 1984; Krugman 1987; Harvie 1993; Caballero & Lorenzoni 2007; Stijns 2005) and empirical studies (Mardaneh 2012; Hasanov 2013; Égert 2012; Valeriy et al. 2015). The review focus on the Dutch disease is to highligh important signs to demonstrate its existence. These symptoms are considered in the following Subsections 5.2.1–5.2.4 and comprise continually increasing world oil prices, appreciating real exchange rate, declining real non-oil output and exports, deteriorating non-oil tradeable sector, expanding non-tradeable sector and increasing domestic prices.

5.2.1 Symptom 1—increasing world oil price

The Libyan economy is heavily dependent on oil production and exports. The share of real oil GDP is about 65% of total real GDP and oil exports account for more than 75% of total exports, during 1970–2016. Oil production and export are reliant on world oil prices, which are determined exogenously and are often volatile (Yahia & Saleh 2008; Ali 2011; Fargani 2013; Etelawi et al. 2017; Otman & Karlberg 2007; Alimohamed 2014; World Bank 2016).

Figure 5.1 shows that the price of crude oil was stable, with only a slight decline, from the mid-1980s–early 2000s. However, the crude oil price then increased fivefold in the decade to 2010, with the exception of the fall in 2008 during the great recession. There was a significant fall of around 50% in 2015. These effects witnessed international causes of the strong and variable growth in the oil price during this later period.

Figure 5.1. World average oil prices (US$ per barrel).



Source: OPEC (2016); World Bank (May 2019).

Further, higher oil revenue associated with higher oil prices and export quantities results in a domination of the economy by the oil sector (e.g., increased investment and production in the oil-producing sector) (Hamed 2009; Masoud 2009; Alfergani 2010). As a corollary, there is a lack of economic diversification (Alimohamed 2014; Ahmouda 2014; Ali & Harvie 2017).

5.2.2 Symptom 2—appreciating real exchange rate

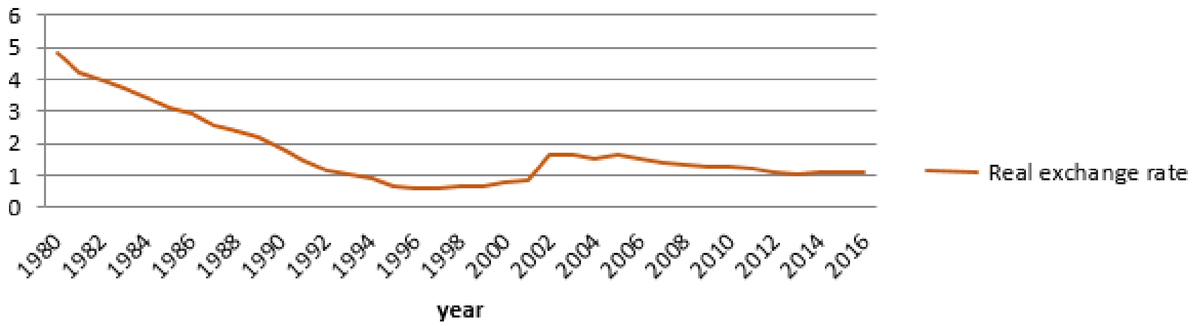
Revenues from oil exports are the most important source of foreign exchange earnings in Libya, accounting for more than 95% of all foreign exchange holdings in 1980–2016 (Ali-Mohamed 2014; World Bank 2016). The trade balance has been dominated by oil exports revenue inflows and the increasing supply and its variability of foreign exchange has affected the nominal and real exchange rates (Otman & Karlberg 2007; Ali & Harvie 2017; Fargani 2013; World Bank 2016). This affects other sectors, especially the tradeable manufacturing sector, and the trade balance of the non-oil sector, which consequently affects real output of the non-oil sector (Ali 2011; Alimohamed 2014; Ahmouda 2014).

These effects on, and of, the nominal and real exchange rate in an oil-exporting economy are conditions that are crucial for the existence of Dutch disease (Wijnbergen 1984; Krugman 1987; Harvie 1993; Valeriy et al. 2015). The appreciation in the real exchange rate is the main symptom of Dutch disease for many oil-exporting countries, regardless of whether they are developed or developing. Considerable literature (for example see Oomes & Kalcheva 2007; Valeriy et al. 2015) has investigated the Russian context. Jahan-Parvar et al. (2012) examined 14 oil-exporting countries and Hasanov (2013) inspected Azerbaijan. Ali and Harvie (2015a, 2017) and Omolade and Ngalawa (2017) researched Libya and concluded that world oil price shocks have a statistically significant impact on the appreciation of the real exchange rate.

The real exchange rate is the real domestic LYD price of the US$, such that a reduction in its value is a relative appreciation of the LYD and concomittant depreciation of the US$. Figure 5.2 depicts the real exchange rate appreciating from 1980–1996. The price of the US$ fell significantly by a little over 80% in this period. It then depreciated by a little over 30% until the IMF induced depreciation in 2003 (IMF 2008). This depreciation was a one-off, within-year jump of nearly 85%. The rate then appreciated by around 45% over this period.

Overall, the real exchange rate has appreciated on average by 80% over 1980–2016. While there was a period of depreciation in the middle term, three-quarters of the period (28 years) experienced real appreciations, compared to nine years of depreciation. The implications of these appreciations for real GDP and particularly for real non-oil GDP will now be considered.

Figure 5.2. Real exchange rate (LYD per US$ in real terms).

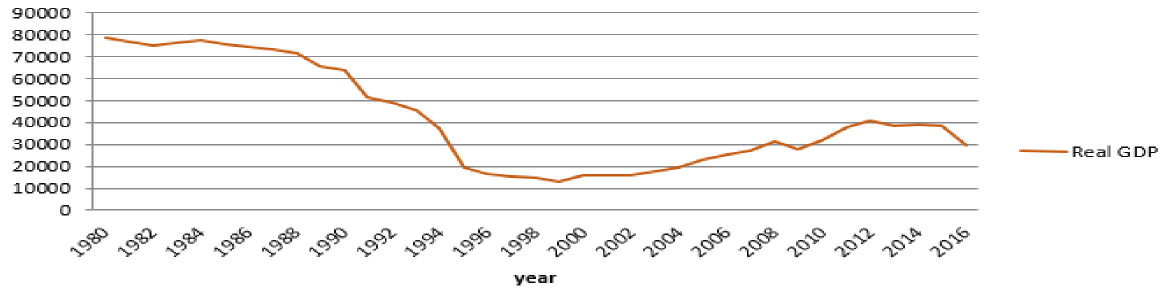


Source: Central Bank of Libya (2014); IMF (2008, 2012, 2016).

5.2.3 Symptom 3—deterioration in real output

Figure 5.3 shows that real GDP declined substantially in the mid-1980s to mid-1990s. It was then stable until the early 2000s, and increased in the next decade, but subsequently has declined.

Figure 5.3. Real GDP (LYD—millions, constant LYD 2010 prices).

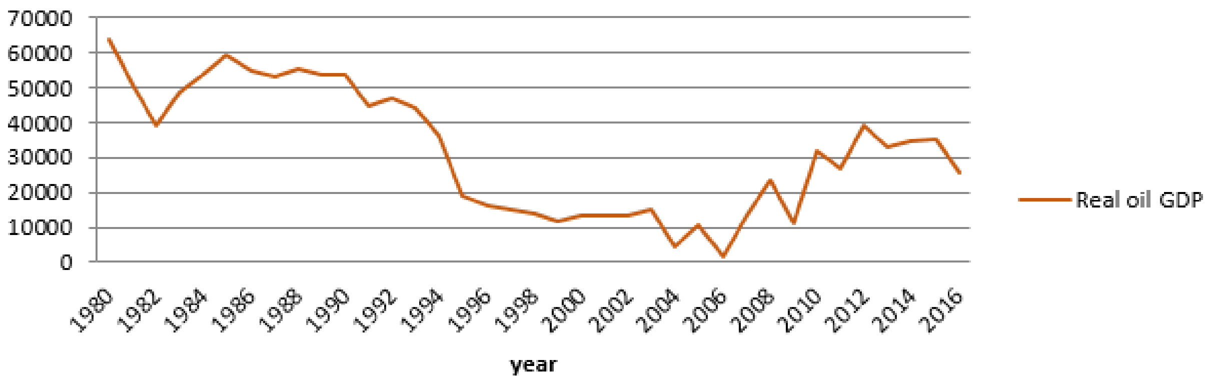


Source: World Bank (2016, 2017).

The initial decline in real GDP in 1980s was caused by the fall in oil production and export (see Chapter 2). This can be observed in Figure 5.4, in which the decline accelerated in the early 1990s. However, changes in real oil GDP were not always the major contributor to real GDP. From 2003–2009, it can be observed by comparing Figures 5.3 and 5.4 that real oil GDP was relatively less important in improving real GDP. This is confirmed by the increase in non-oil GDP in Figure 5.5 for this period. With the exception of 2005–2009, real non-oil GDP has been at very low levels since 1992, that is, for the last 25 years. This follows the substantial appreciation of the real exchange rate (see Figure 5.2) from 1980–early 1990s. Real non-oil GDP has averaged around 10% of total real GDP during this time.

In comparison, real oil GDP has increased (with variation) from around 2003. This coincides with the increase in the world oil price (see Figure 5.1). Importantly, the five-year boom period for non-oil GDP followed directly from the significant real depreciation in 2002. It declined from around 2006, which also coincides with the subsequent appreciation of the real exchange rate.

Figure 5.4. Real oil GDP (LYD—millions, constant LYD 2010 prices).

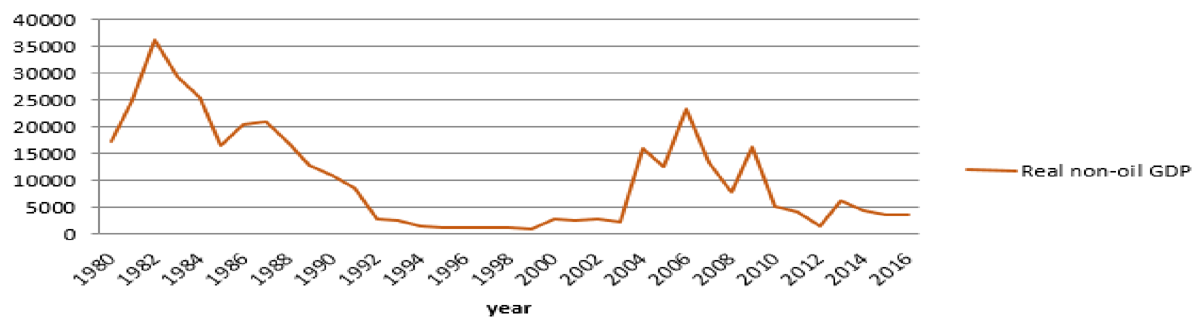


Source: World Bank (2017); Central Bank of Libya (2014).

The low levels of real non-oil GDP can be broken down into non-oil tradeable sectors, such as manufacturing and non-tradeable sectors like services (Hasanov 2013; Valeriy et al. 2015). The services sector contributed 15% and the construction sector constituted 13% of total GDP on average in 1980–2016 (Masoud 2013; World Bank 2016; see Table 2.4).

The growth in the services sector averaged around 17% between 2002 and 2010, which suggests that the boom in the oil sector in these years increased demand for services (see Table 2.4). At the same time, manufacturing and agriculture only contributed on average of 5% and 2%, respectively, to total GDP, over 1980–2016 (World Bank 2016; see Table 2.4).

Figure 5.6. Real non-oil GDP (LYD—millions, constant LYD 2010 prices).



Source: World Bank (2016, 2017); Central Bank of Libya (2014).

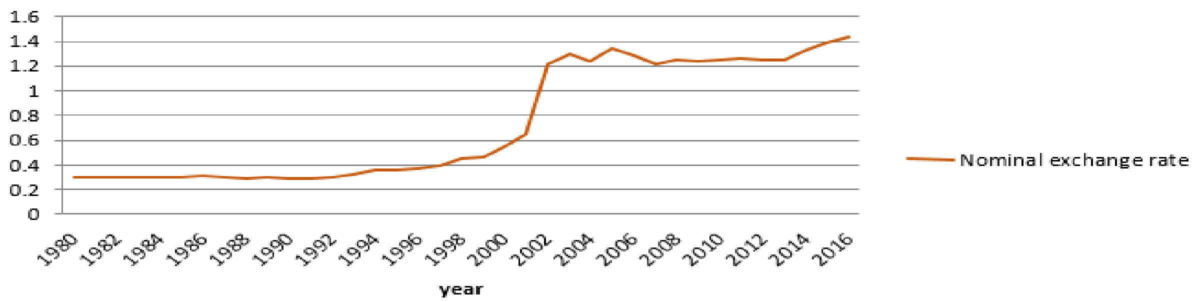
Based on Figures 5.1 and 5.4, there is an apparent correlation, as expected, between world oil prices and real oil GDP. This means that while growth in the oil sector was underpinned by strong oil prices, development in the oil sector had no positive impact on the non-oil tradeable sectors: manufacturing and agriculture (IMF 2006, 2008, 2012; Fargani 2013; Alimohamed 2014). Deterioration of the non-oil tradeable sector and real non-oil sector are major symptoms of Dutch disease.

In this case, Dutch disease leads to a structural problem in the economy in terms of components of real GDP and exports. In Libya, the focus on the exports of oil and the lack of output diversification renders an economy less stable, particularly when experiencing external economic shocks (Ali 2011; Fargani 2013; Alimohamed 2014). The role of prices will now be considered.

5.2.4 Symptom 4—increased domestic price

Given the substantial periods of appreciation in the real exchange rate, it is worthwhile to consider the role of the nominal exchange rate. Figure 5.7 shows the nominal rate has exhibited little variation other than the massive IMF prompted depreciation in 2002. There was gradual depreciation in the 1990s, followed by depreciation in 2002 (approximately 100%). The rate has since flattened, with recent small depreciations since 2014.

Figure 5.7. Nominal official exchange rate (LYD per US$).



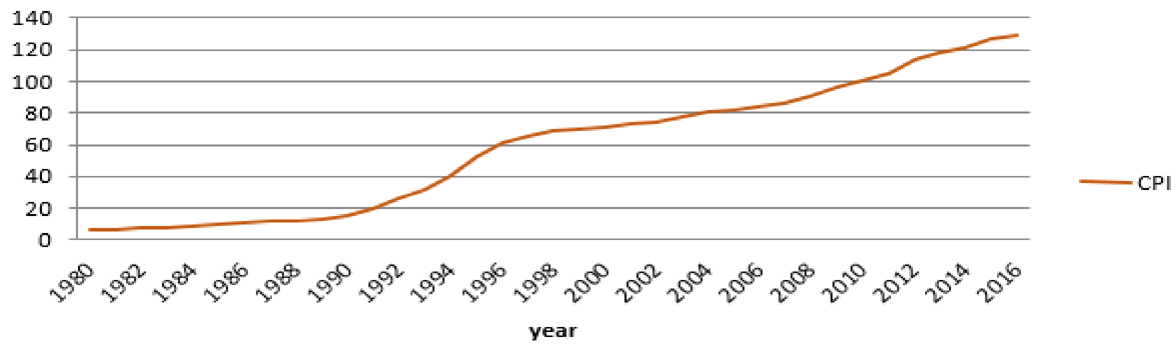
Source: IMF (2006); Central Bank of Libya (2009, 2010, 2014, 2016); World Bank (2016).

It appears this rate is a managed exchange rate, as explained previously. Given the log-linearised PPP relationship from the model in Chapter 4, the real exchange rate is equal to $e_t + p_t^* - p_t$, where e_t is the nominal exchange rate, p_t^* is the overseas price level and p_t is the domestic price level. If the nominal rate is held fixed or managed, and the overseas (oil) price is increasing, appreciation in the real exchange rate (US$ decreases in value) implies the domestic price level needs to not only increase, but to increase by more than the increase in the overseas price. Figure 5.8 shows the required increases in the domestic price level. The accelerated increase in 1992–1995 was due to the depreciation of the nominal exchange rate in 2002 requiring higher domestic price via the PPP condition. This increase is not directly attributable to changes in the world oil price, which remained flat during these years (see Figure 5.1).

In some empirical studies, differences in wage rates across sectors have been used as an indicator of Dutch disease (Égert & Leonard2008; Égert 2012; Covi 2013; Hasanov 2013). These studies sought to investigate and expand the understanding of the resource movement explained by Corden and Nearly (1982) and Corden (1984). This study explores prices rather than wages because wage rates refer to resource movements, which are more relevant to the 'resource curse' view, rather than Dutch disease. The focus of this discussions is the 'spending effect', since it is more significant than the 'resource movement effect' in the case of Libya (Ali 2011; Ali & Harvie 2015b).

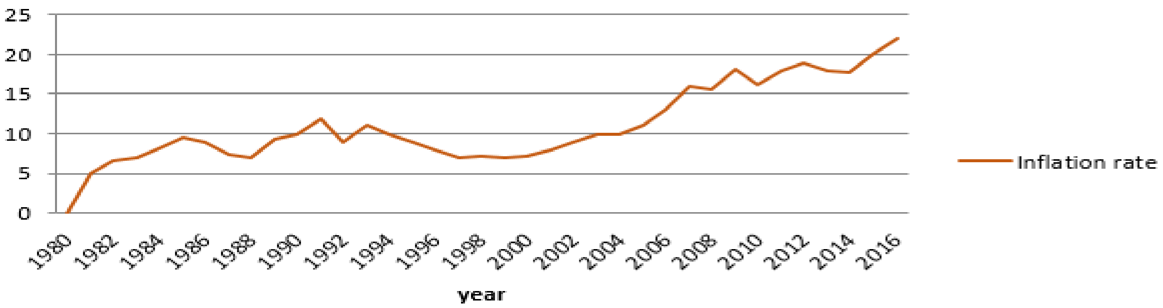
Figure 5.8. Consumer price index (2010 = 100) and inflation.

Figure 5.8.A. Consumer price index (2010 = 100)



Source: World Bank (2016); Central Bank of Libya (2014, 2016).

Figure 5.8.B. Inflation rate (calculated from the CPI)



Source: World Bank (2016); Central Bank of Libya (2014, 2016).

In summary, focusing on the later period—the beginning of the 2000s—the increase in world oil price coincides with an increase in real GDP due to an increase in real oil GDP. There is an appreciation of the real exchange rate and a fall in real non-oil GDP, with domestic price increasing. These qualitative findings of the symptoms of the Dutch disease are listed in Table 5.1 (Covi 2013, Oomes & Kalcheva 2007; Égert & Leonard 2008).

Table 5.1

Overview of the Symptoms of Dutch Disease in Libya

Observation		Finding
1.	Rise in world oil price	Yes
2.	Appreciation of the real exchange rate	Yes
3.	Appreciation of the real exchange rate due to the relative price of non-oil tradeable sector	No conclusion
4.	Reduction in real non-oil GDP	Yes
5.	Increase in domestic price level	Yes
6.	Increase in domestic price due to the managed nominal exchange rate	Tendency to yes

The presence of these Dutch disease symptoms warrants further attention and encourages further analysis of the transmission channels by which world oil prices affect key macro-economic variables in Libya. This will continue with econometric testing, estimation and simulation in the following sections of this chapter.

5.3 Pre-Estimation Testing

The variables chosen to examine Dutch disease in this exploratory chapter are listed in Table 5.2. Each variable has 37 annual observations for 1980–2016. This is the longest available dataset; higher frequency data are not available. These variables will initially be used to analyse the presence of Dutch disease in the Libyan economy resulting from a shock in world oil prices through two models. Model 1 first investigates the influences on the real sector via real GDP (RGDP), while Model 2 focuses on the effects on real non-oil GDP (RNOGDP).

Table 5.2

Description and Sources of Data

Variable	Description	Math notation	Source
WROILP	World average oil price (US$ per barrel)	po_t	WB-OPEC
REXN	Real exchange rate (real LYD per US$) The real exchange rate is the log of the nominal Dinar-US exchange rate times (e_t) plus the log of the imported goods price index (p_t^n) less the log of the domestic consumer price index (p_t). The foreign price level is the imported goods price index and the domestic price level is the consumer price index. Thus, (Sources: IMF 2008, 2013, 2018, World Bank 2016, Ali 2011).	$e_t + p_t^n - p_t$	IMF-CBL
RGDP	Real GDP (million LYD, constant LYD 2010 prices)	y_t^{RI}	WB -CBL
RNOGDP	Real non-oil GDP (million LYD, constant LYD 2010 prices)	No_t^s	WB -CBL
CPI	Consumer price index (2010 = 100)	p_t	WB-CBL

Sources: WB = World Bank Annual Report, 2016, 2017, May 2019.
OPEC = Organization of the Petroleum Exporting Countries Annual Report, 2016.
IMF = International Monetary Fund country Report, 2006, 2008, 2012, IMF 2016.
CBL = Central Bank of Libya Annual Report, 2009, 2010, 2014, 2016.

The essential pre-estimation test determines if the time series data are stochastic stationary. Estimations were conducted using the EViews 8 program.

5.3.1 Stationarity

The augmented Dickey-Fuller (ADF) tests results are summarised in Table 5.3. The null hypothesis of the test is that there is no unit root. Sequential testing was conducted for each variable, starting with levels, then first difference and higher differences, until the null hypothesis is rejected. They indicate the world oil price (WROILP) and real exchange rate (REXN) are non-stationary $I(1)$ in levels, and stationary $I(0)$ in first differences at the 1% level of significance. RGDP was found to be non-stationary $I(1)$ at the 1% level and stationary $I(0)$ in first differences at only the 5% level, with the 1% level indicating second differencing (or higher) is required for stationarity. In contrast, RNOGDP appears stationary in levels $I(0)$, at 1%, while the consumer price index (CPI) is only stationary after second differencing $I(2)$, at the 1% level.

Table 5.3

ADF Unit Root Test

		t-statistic		Result
Variable	Level	First difference	Second difference	
WROILP	−1.328	−5.633***	-	$I(1)$
REXN	−2.454	−3.812***	-	$I(1)$
RGDP	−1.478	−3.480**	-	$I(1+)$
RNOGDP	−3.827***	-	-	$I(0)$
CPI	−0.201	−2.537	−6.186***	$I(2)$

These variables appear to be of complicated mixed orders according to the ADF test. However, it is well known that the test lacks power to reject the null hypothesis of a unit root in the presence of structural change. This is because structural change introduces permanent effects on the time series, which can be misinterpreted as a permanent shock to a stochastic trend representation like $y_t = y_{t-1} + e_t$, which describes a non-stationary unit root process. Thus, it is possible that the variables are not necessarily non-stationary and higher levels of differencing may be unwarranted.

There are numerous extensions of the ADF test, which incorporate the presence of single and multiple structural change points that may be predetermined or endogenously determined. The review in Chapter 2 cited many instances of possible structural changes in Libya due to economic, political and cultural factors. However, little is known about the accuracy of the data spanning 37 years for a developing country like Libya, including inconsistencies in terms of origins, definitions and accuracy of the time series data. Therefore, it would be difficult to disentangle these effects to identify unit root processes correctly. Extensive analysis of these possible effects risks data mining and inadvertently introducing biases in the data with subsequent re-specifications of the data. Given this is an exploration in this chapter, this line of enquiry will not been continued here. Rather, the available raw data is used to identify the empirical results' initial findings. This will be the first step of further work in subsequent chapters.

Given the possibility of non-stationarity in the time series and the presence of 'spurious relationships' between them (as discussed in Chapter 4), many researchers take the precaution of differencing the data to remove any undetected stochastic trends. The problem with this approach is the possibility of mixed orders of data. Keeping some variables in levels and transforming others into first or second differences is inconsistent with the model developed in Chapter 4. This is a standard dynamic macro-economic model specified in levels. Moving away from this theoretical framework by taking first (or higher) differencing of the data creates ambiguity in interpretation. For example, some have argued that first differencing removes long-term effects and focuses on short-term variations (Nguyen 2014). Conversely, first differencing (especially of data in logs) moves the specification towards a growth model, in which the generating process is in terms of long-term trends (Du *et al. 2*010). Researchers have alternately allowed for possible non-stationarity by removing the deterministic trends from the time series data (Dungey & Pagan 2000). However, this changes the model to one of a business cycle around the estimated trend with underlying theory focusing on productivity shocks rather than on exogenous oil price shocks. Other methods to de-trend the data using techniques like the Hodrick–Prescott filter have well-documented problems of potentially introducing a pre-estimation bias.

5.3.2 Cointegration

A popular alternative to adjusting the data is to use cointegration analysis to estimate the long-term relationships of non-stationary data. While the ARDL procedure is appropriate for mixed order, $I(0)$, $I(1)$ and $I(2)$ regressors, it is limited to single equation analysis. Given the interest here to study the dynamic interplays between variables in a dynamic simultaneous equations model, this procedure is not useful. Applying the Johansen (1988) simultaneous equation method provides the estimates of long-term cointegrating relationships in a simultaneous equations setting. Unfortunately, it has unknown properties for mixed-order variables. The result of preliminary cointegration estimation is reported in Appendix 5, Section A5.1. Tables A5.1 and A5.2 include plausible long-term estimates supporting the existence of Dutch disease. However, Figures A5.1 and A5.2 indicate problems with the dynamic responses to an oil price shock. Of the three main issues, the first is that a shock to the world oil price forces permanent effects. The second is that moving to this new equilibrium requires contradictory adjustments to the real exchange rate. The exchange rate is required to depreciate for real GDP and appreciate for real non-oil GDP. The third problem is that some of the dynamic short-run error correction adjustments are unstable. The mixed order of stationarity $I(0)$, $I(1)$ and $I(2)$ for the variables may affect the short- and long-term estimates.

SVAR analysis allows the simulation analysis of the dynamics in a simultaneous equations system (Berkelmans 2005; Aslanidi 2007 cited in Nguyen 2014). It incorporates the dynamics in terms of the reduced form VAR and the contemporaneous effects via the structural form (SVAR). It is a well-known and extensively used procedure, well suited to identifying and tracing the different channels of effects of shocks. It is also popular for analysing monetary and fiscal policies, which will be conducted in the following chapters.

As mentioned previously, many researchers facing the possibility of non-stationary data take first differences of the variables; this is also done with SVAR. As argued previously, differencing data is inconsistent with the theoretical model and provides ambiguity in interpreting the dynamics, which is the focus of this chapter. In any case, differencing is frequently not necessary according to Sims et al. (1990, p. 136):

> This work shows that the common practice of attempting to transform models to stationary form by difference or cointegration operators whenever it appears likely that the data are integrated is in many cases unnecessary … It will often be the case that the statistics of interest have distributions unaffected by the nonstationarity, in which case the hypotheses can be tested without first transforming to stationary regressors.

According to Sims *et al.* (1990), Kim and Roubini (2000) and Nguyen (2014), the important focus of SVAR estimation is whether the estimates have standard distributions, rather than being integrated in the regressors.

Indeed, first differencing may also cause a loss of information in the relationships of effects (Dungey & Pagan 2000, 2007, 2009; Sims 1992; Cushman & Zha 1997; Kim & Roubini 2000; Afandi 2005; Zaidi & Fisher 2010; Zaidi 2011). Appendix 5 Section A5.2 shows this is true for a shock to the world oil price in the SVAR with the variables first differenced. As can be observed in Appendix Figures A5.3 and A5.4, the shocks damp too quickly for a developing country like Libya, and do not reveal any informative dynamic adjustments over time.

Du et al*.* (2010) also argued that first differencing is not necessary since the variables must be stationary to be able to transfer the SVAR into its infinite moving average representation to obtain the impulse response functions (IRFs) and the forecast error variance decompositions (VDs). It has to be acknowledged that estimates from the IRFs from a cointegrated VAR are more precise than those from a VAR levels (Johansen 1988). However, this can be countered by imposing restrictions in the SVAR so that the impulse response can provide more accurate results (Kim & Roubini 2000).

SVAR in levels allows exploration of these relationships and analysis of the reactions of domestic variables to external shocks (Berkelmans 2005; Aslanidi 2007 cited in Nguyen 2014). It provides a more in-depth exploration of the relationships (Kim & Roubini 2000; Afandi 2005) and less loss of information (Dungey & Pagan 2000, 2007, 2009; Sims 1992; Cushman & Zha 1997; Kim & Roubini 2000; Afandi 2005; Zaidi & Fisher 2010; Zaidi 2011; Kutu & Ngalawa 2016).

There is evidence that the SVAR in levels often produces consistent parameter estimates irrespective of whether the time series are integrated. The inclusion of lags in the VAR can make the residuals stationary and affect the distributions of the statistics (Nguyen 2014). This will now be considered.

5.4 Testing for Dutch Disease with SVAR Estimation

The SVAR estimation and testing is conducted in two stages. The first stage specifies the A_0 matrix in the SVAR:

$$A_0 X_t = A(L) X_t + B\varepsilon_t \qquad 5.1$$

The specification is guided by the theoretical model developed in Chapter 4. The second stage involves identifying the optimal lag $C(L)X_t$ in:

$$X_t = C(L) X_t + u_t \qquad 5.2$$

This VAR is estimated and the coefficients in the SVAR contemporaneous matrix A_0 in (5.1) are derived using the relationship $A_0 u_t = B\varepsilon_t$. Residual-based tests are conducted to ensure the dynamic relationships are free of serial correlation and other issues, including stability of the model (Zaidi 2011; Dalimunthe 2013; Kutu & Ngalawa 2016). These stages will now be conidered.

5.4.1 SVAR specification and identification

As mentioned previously, two models will be specified and identified. The first model includes the variables WROILP, REXN, RGDP and the CPI which are key factors in the literature to examine the existence of Dutch disease, especially for developing oil-exporting countries, including MENA (see Moshiri & Banihashem 2012, cited in Kose & Baimaganbetov 2015; Ali 2011; Ahmoda 2014; Égert & Leonard 2008; Kutan & Wyzan

2005). The justification for initially focusing on these few key variables is further supported by the structural factor VAR (SFVAR) approach of Bernanke et al. (2005), which argues that these selected variables summarise important aspects of the macro-economy, capturing underlying economic relationships (Liu & Jansen 2013).

In the specification of the SVAR, the first assumption is that oil price shocks are exogenous, affecting domestic variables and not vice versa. This assumption is plausible since Libya is an oil-exporting, small, open economy, so oil price shocks influence the domestic variables in the system (Yahia & Saleh 2008; Ali & Harvie 2015a; Ahmouda 2014; Omolade & Ngalawa 2017). Therefore, world oil price shock (WROILP) should be placed in the first row of the X matrix (Kim & Roubini 2000; Zaidi 2011; Hililan 2013). The domestic variables are to be placed in rows from least to most endogenous (Cushman & Zha 1997; Dungey & Pagan 2000; Berkelmans 2005; Tang 2006). This is illustrated by the real exchange rate (REXN) located in the second row being primarily affected by the world oil price. A supporting reason that REXN is placed in the second row is because the NEXR is appropriately assumed to be managed in Libya over the these years (1980–2016). Real GDP (RGDP) is set in the third row, as it is affected by the world oil price and the real exchange rate. The CPI variable is placed in the bottom row because it is assumed to be the most endogenous variable in this matrix, affected by all variables included in this model.

These assumed relationships are specified in the coefficients in the structural specification for A_0. The lower-triangular coefficients indicate the recursive nature of the system. The external world price variable affects the domestic variables, which affect each other but not the overseas-determined variable.

$$A_0 X_t = \begin{bmatrix} 1 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix} \begin{bmatrix} WROILP_t \\ REXN_t \\ RGDP_t \\ CPI_t \end{bmatrix}$$

Model 2 modifies this specification and only differs by replacing RGDP with RNOGDP to further highlight the adverse effects of an oil price shock on the non-oil sector.

Further justification for this specification is found in the theoretical model outlined in Chapter 4. The real exchange rate is defined as $er_t = (e_t - p_t)$, where e_t is the NEXR defined as the domestic price of foreign exchange (such that a decrease in this price is an appreciation in the value of the Libyan currency) and p_t is the domestic price. The revenue from oil exports is given by $(o_t^x + po_t + er_t)$, where o_t^x is oil production and po_t is the world oil price. An increase in the oil price will boost oil revenues and the capital inflow will appreciate the nominal and real exchange rates. The impact of oil price on the real sector is considered part of the pure Dutch disease model in which the macro-economic stimuli are muted. The a_{21} coefficient in A_0 captures the structural effect of world oil price on the real exchange rate.

The real exchange rate is also proposed to contemporaneously affect real GDP and the CPI. The exchange rate and imported prices index have a significant impact on real GDP and prices (Ali 2011; IMF 2006; Cevik & Teksoz 2014). An appreciation of the exchange rate in Libya has a negative impact on the non-oil exports sectors, as it leads to an increase in price (Ali & Harvie 2015; Omolade & Ngalawa 2017). This assumes that higher oil prices would lead to an appreciation in the real exchange rate. Owing to the appreciation of the real exchange rate, the price of imported goods would be lower than domestic non-oil goods, especially consumer goods, which would become expensive and less competitive in the domestic and global markets (Ahmouda 2014).

This effect is shown in the model by increasing consumer imports m_t^{con}:

$$m_t^{con} = c_8 - a_{81}^0(e_t + p_t^n - p_t) + \sum_{i=1}^{K} a_{82}^i y_{t-i}^{RI} \qquad 4.15$$

and falling non-oil exports x_t^n:

$$x_t^n = c_7 + a_{71}^0(e_t + p_t^n - p_t) + \sum_{i=1}^{K} a_{72}^i y_{t-i}^{RI} \qquad 4.13$$

The current account, CA_t balance, will fall due to the worsening non-oil trade balance, $(No_{t-i}^x - No_{t-i}^m)$, and the appreciating real exchange rate er_t:

$$TRB_t = c_{16} + \sum_{i=1}^{K} a_{161}^{i} po_{t-i} + \sum_{i=1}^{K} a_{162}^{i} o_{t-i}^{x} + \sum_{i=1}^{K} a_{163}^{i} Eer_{t-i} + \sum_{i=1}^{K} a_{164}^{i} (No_{t-i}^{x} - No_{t-i}^{m}) \quad 4.28$$

$$CA_t = c_{17} + \sum_{i=1}^{K} a_{161}^{i} po_{t-i} + \sum_{i=1}^{K} a_{162}^{i} o_{t-i}^{x} + \sum_{i=1}^{K} a_{163}^{i} Eer_{t-i} + \sum_{i=1}^{K} a_{164}^{i} (No_{t-i}^{x} - No_{t-i}^{m}) + \sum_{i=1}^{K} a_{165}^{i} r_{t-i}^{*} f \quad 4.29$$

This will adversely affect RGDP and the coefficient a_{32} in A_0 captures these effects. The justification for including coefficient a_{31} in A_0 is the positive effect of the oil price increase on real income:

$$y_t^{RI} = c_9 + \sum_{i=1}^{K} a_{91}^{i} No_{t-i}^{s} + \sum_{i=1}^{K} a_{92}^{i} (o_{t-i}^{x} + po_{t-i} + er_{t-i}) + \sum_{i=1}^{K} a_{93}^{i} (e_{t-i} + p_{t-i}^{n} - p_{t-i}) \quad 4.17$$

Another assumption is that rising consumer prices can occur through the gap between the demand for non-oil GDP and supply of non-oil GDP ($No_t^d - No_t^s$) (Cox & Harvie 2010). A positive oil price shock will result in higher domestic prices. Chapter 2 demonstrates the purpose of this assumption for the oil-exporting Libya. Higher oil prices potentially result in significant oil revenue and higher government expenditure (Alimohamed 2014). Consequently, the Libyan government spends more on consumption than it does on investment (Fargani 2013; Central Bank of Libya 2016). This contributes to the increase in imported goods for consumption at the expense of investment. Subsequently, economic growth drops and prices increase (IMF 2016).

The domestic price level p_t is a weighted average of the domestic currency price of oil $(e_t + po_t)$ and the domestic currency price of the imported non-oil goods $(e_t + p_t^n)$, which is represented by the imported goods price index in foreign currency, multiplied by the exchange rate:

$$p_t = c_{13} + \sum_{i=1}^{K} a_{131}^{i} w_{t-i} + \sum_{i=1}^{K} a_{132}^{i} (e_{t-i} + po_{t-i}) + \sum_{i=1}^{K} a_{133}^{i} (e_{t-i} + p_{t-i}^{n}) \quad 4.24$$

These effects on the domestic price level are captured by the coefficients a_{41} in A_0 for the direct effect of the oil price, a_{42} for the effect of the exchange rate and a_{43} for the effect of the trade balance via RGDP. The CPI is assumed to be the most endogenous variable in this model; hence, it is placed in the last row of the matrix. The impact of CPI on itself, given by a_{44}, reflects the persistence of prices and price expectations (Tayler 2000; Romer 2012). Finally, this lower triangulation of A_0 assumes the exchange rate is not contemporaneously affected by the shocks in RGDP and prices, and is supported by Libya's managed exchange rate regime.

The zero resrictions help identify the A_0 matrix. Further identification can be made by diagonalising the B matrix. This clearly shows that a shock to the world oil price will contemporaneously affect the system via the $b_{11}\varepsilon_{1t}$ term only.

$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 \\ 0 & 0 & b_{33} & 0 \\ 0 & 0 & 0 & b_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix}$$

Identification of the system requires $2n^2 - n(n + 1)/2$[37] restrictions, which for $n =$ 4, is equal to 22 restrictions on both the A_0 and B matrices. The number of zero restrictions on B is 12 and the number of zero and diagonal restrictions on A_0 is 6, giving a total of 18, plus the 4 restrictions in the diagonal of the A_0 matrix, which are restricted to 1. This gives 22 restrictions, which means the system is exactly identified.[38]

The above assumption accords with Bhuiyan (2008) and Kutu and Ngalawa (2016), who asserted that oil price shocks translate to real output through the exchange rate effect. This SVAR empirical analysis, based on the developed theoretical model, is different to the standard approach used in many studies, which heuristically employ a SVAR benchmark model (Cushman & Zha 1997; Kim & Roubini 2000, 2008; Dungey & Pagan 2000). This research proceeds foundationally based on the theoretical model developed in Chapter 4 for the empirical matrix specifications (Bernanke et al. 2005;

[37] See Nguyen (2014), Afandi (2005) and Kutu & Ngalawa (2016).
[38] The diagonal elements of the B matrix are not restricted and must therefore be estimated.

Boivin & Mihov 2009; Lagana & Sgro 2011; Liu & Jansen 2013). The SVAR estimation and simulation analysis for Models 1 and 2 are now conducted.

5.4.2 Estimating the SVAR for models 1 and 2

The choice of optimum lag length with no residual serial correlation in the VAR is crucial to the dynamic analysis (Dalimunthe 2013). The appropriate lag is required for the correct specification of the VAR, and uncorrelated residuals are required for consistent estimation of the parameters. Therefore, it is important that Johansen's (1995) residual lagrange-multiplier (LM) test is used to check whether there is a serial correlation problem when choosing the lag (Zaidi 2011; Dalimunthe 2013; Kutu & Ngalawa 2016).

Due to the relatively few observations available, possible lag lengths were selected from one to four, k = 1 to 4, for the VAR and the serial correlation was tested for AR 1 to AR 4, h = 1 to 4. The tests were conducted with EViews 10 and the results are presented in Table 5.5 for Model 1 and Table 5.6 for Model 2.

All lag length selection criteria reported in Table 5.5A agree the optimum VAR lag is 1 for Model 1, at the 5% level of significance. The lag length information criteria is sufficient to determine the optimal lag length, which should be chosen appropriately with no serial correlation in the residual term (Berkelmans 2005, cited in Nguyen 2014).

The LM residual test can robustly detect serial correlation (Alkahtani 2013; Dalimunthe 2013). Based on the values reported in Table 5.5B for Model 1, the null hypothesis of no serial correlation cannot be rejected at the 1% level of significance for all four lags. However, there is evidence of serial correlation for lag 4 at the 5% level. Given the optimum VAR lag is 1, there does not appear to be a serious serial correlation problem for Model 1. A lag length of 1 is sufficient to adequately capture all the dynamics in the data for the Libyan economy. Table 5.5A shows that the optimum VAR lag for Model 2 appears to be 1 or 2. The Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) indicate a lag of 1, while the the LR-sequential, final prediction error (FPE) and Akaike information criterion (AIC) select a lag of 2. It is well known the

AIC tends to select higher values and the SC criterion is more reliable if the model is correctly specified. Preference is given to a parsimonious specification for Model 2, sufficient to capture the dynamics and not involve the loss of too many degrees of freedom. The more lags, the more estimated parameters are needed and the more inefficient results are obtained (Zaidi, 2011; Dalimunthe 2013; Kutu & Ngalawa 2016). The LM serial correlation test in Table 5.5B shows there is no serial correlation for Model 2 with a VAR lag of 1 at the 1% level.

Table 5.5A

VAR Lag Order Selection Criteria for Model 1

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–461.06	NA	20469589	28.18	28.36	28.24
1	–261.66	338.38*	307.4*	17.07*	17.97*	17.37*
2	–250.59	16.09	434.7	17.36	19.00	17.91
3	–240.89	11.76	720.2	17.75	20.10	18.54
4	–214.39	25.69	492.6	17.11	20.19	18.15

Notes: Sample: 5 37 (1980–2016) included observations: 33.

- indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table 5.5B

Residual Serial Correlation Test for Model 1

Lags	LM-Statistic	Probability
1	15.47	0.49
2	5.70	0.99
3	8.42	0.93
4	26.82	0.04

Notes: Sample: 1 37 (1980–2016) included observations: 36.
Probabilities from Chi-square distribution with 16 degrees of freedom.
Null Hypothesis: No serial correlation at lag order *h*.

Table 5.6A

VAR Lag Order Selection Criteria for Model 2

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–467.59	NA	30411171	28.58	28.76	28.64
1	–306.14	273.97	4556.7	19.76*	20.67*	20.07*
2	–287.44	27.19*	4056.4*	19.60*	21.23	20.15
3	–279.01	10.22	7259.3	20.06	22.41	20.85
4	–255.71	22.58	6028.7	19.61	22.70	20.65

Notes: Sample: 5 37 (1980–2016) included observations: 33.

- indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table 5.6B

Residual Serial Correlation Test for Model 2

Lags	LM-Statistic	Probability
1	16.53	0.47
2	7.13	0.97
3	8.51	0.93
4	22.14	0.13

Notes: Sample: 1 37 (1980–2016) included observations: 36.
Probabilities from Chi-square distribution with 16 degrees of freedom.
Null Hypothesis: No serial correlation at lag order *h*.

The estimates for Model 1 are reported in the Appendix 5 Section A5.3 in Tables A5.3 and A5.4 for model 1. As a general comment, many of the coefficients appear significant and have expected signs in both the VAR and SVAR, with only a few exceptions in the SVAR. The VAR estimates with the variables in levels show that although some lagged effects are highly persistent, they are less than 1, indicating first differencing is not required. However, these are point estimates, which are possibly biased downward. Despite this, the distributions show they are generally significantly less than 1, so this is evidence against the presence of stochastic trend non-stationarity. This also means the shocks will be non-permanent, which is further evidence against the need for cointegration analysis. The exception is the real exchange rate, which appears to be non-stationary (unit root). This also means the shocks will be non-permanent, which is further evidence against the need for cointegration analysis. The exception is the real exchange rate. While this may be interpreted as evidence of its non-stationarity, it could also reflect the authorities managing the rate over time. There appears memory in the world oil and domestic prices, while RGDP displays more inertia, as expected.

Model 2's results are also reported in Appendix 5 in Tables A5.5 and A5.6. The lagged value for RNOGDP in the VAR is less than that for real GDP in Model 1, indicating less inertia and more variability in the sectoral output. The contemporaneous SVAR results show the world oil price negatively affects RNOGDP and appreciates the real exchange rate, illustrating the possible existence of Dutch disease. A real appreciation also decreases prices. The log likelihood tests show that identifying restrictions are valid for both models.

The residual tests for normality and heteroskedasticity show that the null hypothesis of normality of the multivariate distribution is rejected at the 1% level for both models, using the Jarque-Bera multivariate joint test. However, the four othagonalised univariate distributions indicate that two distributions are normal at the 5% level, with the other two showing skewness and leptokutotoc (peaked). Model 2 is the same, but with an extra skewed distribution at the 5% level. These results justify the previously discussed suspicions about the data and the decision to not data mine with differing specifications. The multivariate test for hetroskedasticity shows the null hypothesis of no hetroskedasticity cannot be rejected at the 5% level for both models.

These results positively indicate correct specification with the optumum lag. There is no serial correlation indicating OLS estimation of the VAR should provide consistent estimates, and there is no heteroskedasticity. While some aspects of the distribution are normal, there is evidence of skewed and peaked distributions. This latter result shows that care needs to taken when interpreting SVAR estimates. As argued previously, the SVAR analysis correctly does not pay attention to the numerical values of the estimated parameter values, nor does it makes inferences about their distributions. Instead, it focuses on tracing the dynamic responses and interactions of the variables in the model to the exogenous shock. This important characteristic of the model will now be considered in terms of simulation via the IRFs and VDs.

5.5 Simulations

This section aims to conduct simulations to analyse evidence of Dutch disease in Libya in terms of the responses of RGDP, RNOGDP, the real exchange rate and the CPI to a world oil price shock. The SVAR and VAR estimates are used to derive the IRFs that simulate the contemporaneous and dynamic responses of the domestic variables to the external shocks (Morin & Stevens 2004; Stephen et al. 2014; Breitung, Jörg, Brüggemann & Lütkepohl 2004). The VDs show the relative importance of the variables over different time horizons by estimating the proportions of the variance of each variable attributable to each structural shock (Raghavan & Silvapulle 2010).

As reported in the Appendix A5.4 Table A5.7, the characteristic roots are all less than 1, indicating the VARs for Models 1 and 2 are stable. These results support the previous discussion advocating leaving the variables in levels for the VAR, rather than first differencing them. No roots outside the unit circle means that the VAR variables have finite variance. A cointegrating relation with VECM would have roots equal to 1, which forces shocks to have permanent effects. This was found and reported in Section 5.3.2. All estimated characteristic roots are complex, with imaginary components indicating cyclical rather than monotonic dynamic behaviours of the variables. The stability tests show that the amplitudes of the cycles around steady state will reduce over time (Sugiarto 2015).

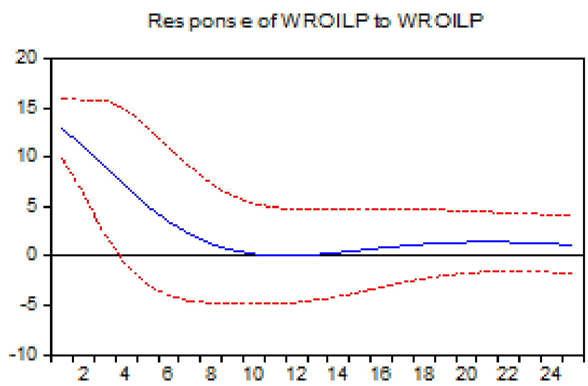
Section 5.5.1 further explains the IRF for Models 1 and 2. They simulate effects over the short run (1–5 periods), medium run (6–10 periods) and long run (11–25 periods).

5.5.1 Impulse response functions.

The impulse response functions used to conduct the simulation analysis of this thesis are derived by the Cholesky decomposition method and calculated analytically (rather than using Monte Carlo bootstrapping). As such, they are asymptotic values and therefore only a guide for the small data samples available in this study. The impulse response functions all have 2-se error confidence intervals. The impulse response function used in this study is based on those used in recent SVAR studies such as Zaidi (2011), Hililan (2013) and Nguyen (2014).

The innovation considered is a one-off increase in the world oil price by one standard deviation. This occurs only in the first period and becomes zero in the following periods. However, in Figure 5.9, the effect of the shock continues over time, declining slowly to zero over 10 periods. The confidence intervals are plus and minus two standard deviations. The estimates of these confidence intervals need to be interpreted with care due to the previously discussed issues with the data. It is expected that they are biased but consistent.

Figure 5.9: Impulse response of world oil price to a world oil price shock



The IRF for Models 1 and 2 are shown in Figure 5.10. For Model 1, the response of RGDP to this shock is positive, increasing to a peak in the short run at around the third period, and declining to zero at around the eighth period. It then turns negative and RGDP continues to fall at an increasing rate until period 13. It then moves to neutral in the long run after 20 periods. The decline from period 3 follows the appreciation of the real exchange rate from period 1. The initial effect on the exchange rate is minimal, but intensifies over time, reaching a maximum after around six periods and continuing until around the 15th period. The subsequent depreciation precedes the improvement in

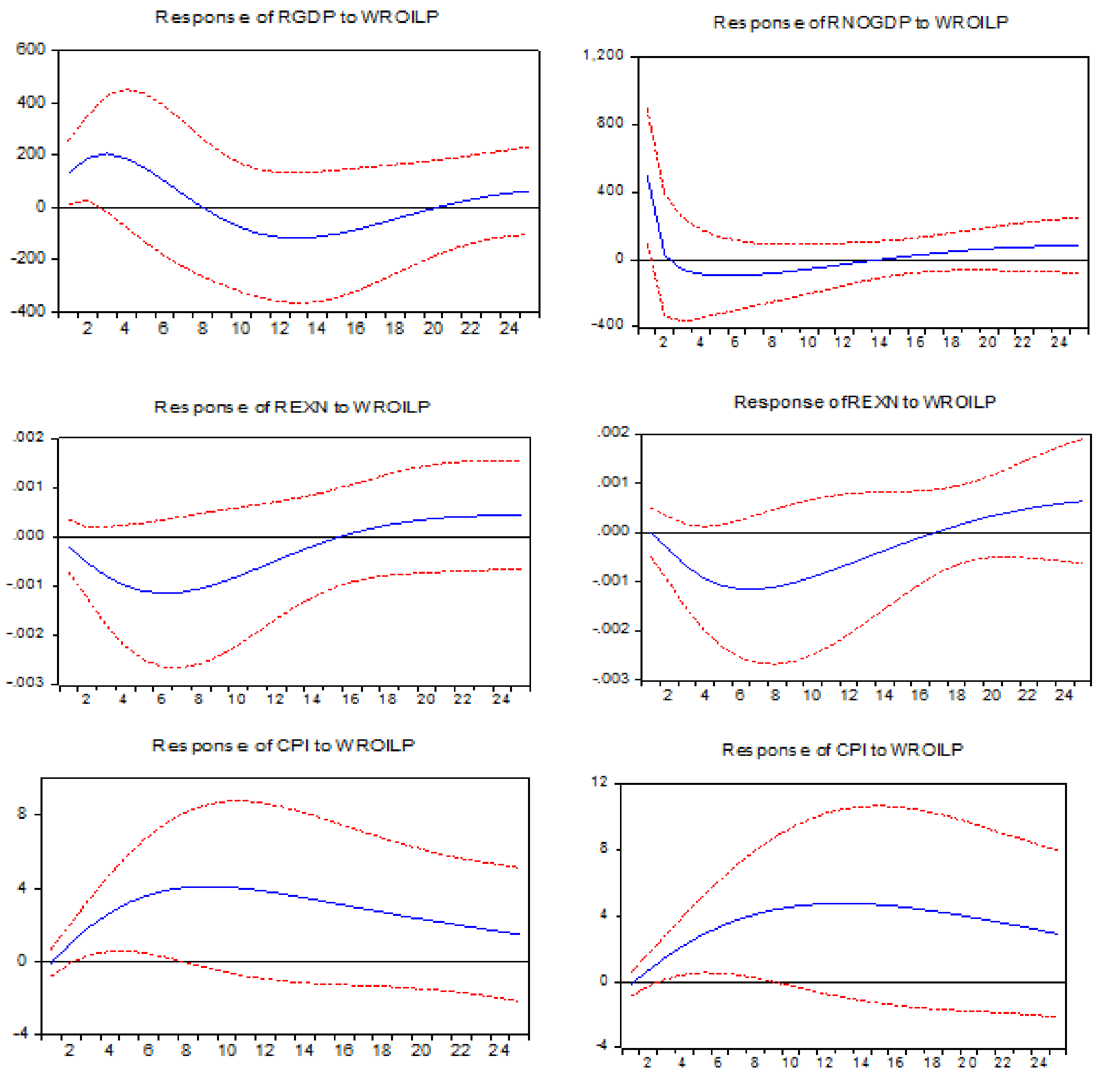
RGDP. This is a very interesting result and is consistent with Dutch disease, in which the emerging appreciation of the real exchange rate increasingly negates the initial positive effect of the oil price increase on RGDP. The oil price shock does not initially affect prices; it induces substantial cumulative increases in the CPI to the medium run, and then a relatively slow decline in the long run.

In summary, while the positive innovation to the world oil price lasts until the medium term, the real appreciation continues for a longer period and the improvement to RGDP is limited to the short term. The negative effect on RGDP continues from the medium to long term and the adverse increase in prices continues over the long run.

This positive and then negative response of RGDP is further examined in Model 2 by replacing RGDP with NROGDP to observe the response of the non-oil sector. It would be expected that the appreciation would more negatively affect this sector. The IRFs for Model 2 (see Figure 5.10) show the appreciation is very similar in magnitude and timing to those in Model 1. However, the effect on non-oil real output is striking, with the initial positive response being eliminated within one period. The negative effect continues for around 12–13 periods, similar to that for RGDP. There is no initial short-term benefit to non-oil real output. There are also long-term adverse effects on prices. This possibility of a sustained effect of a world oil price shock on macro-economic variables, such as non-oil GDP and inflation, is the first symptom of Dutch disease (Mardaneh 2012).

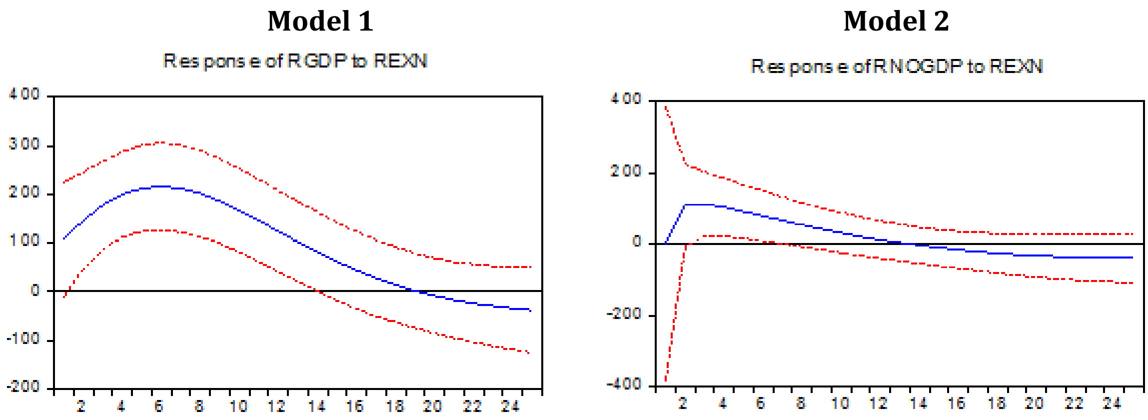
Figure 5.10. Impulse responses of RGDP and RNOGDP to a world oil price shock.

Model 1 **Model 2**



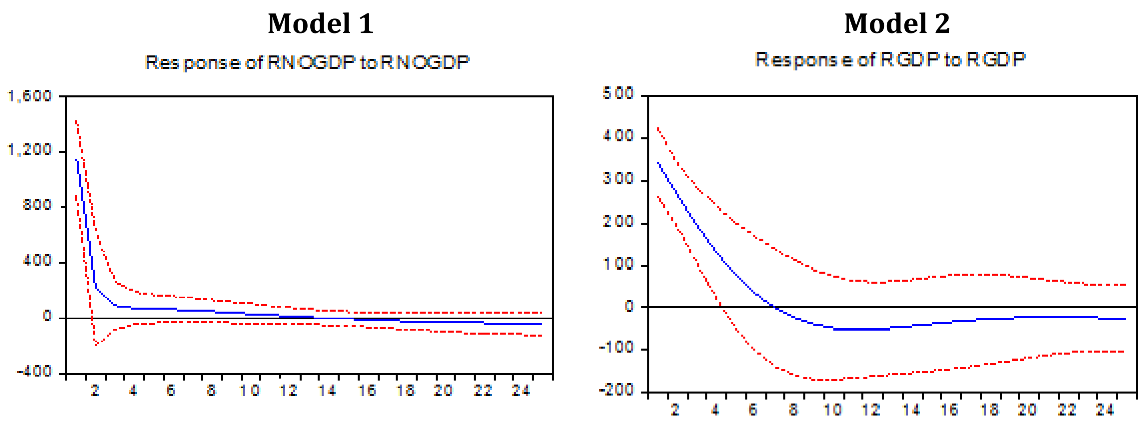
The specific relationship between the real appreciation and response of RGDP and RNOGDP is further highlighted in Figure 5.11. The innovation shown is a positive one standard deviation shock to the real exchange rate. This increase represents a depreciation of the real exchange rate; the IRFs in Figure 5.11 clearly show the positive effects on RGDP and RNOGDP. Inverting this shock implies that the observed decreases in RGDP and RNOGDP in Figure 5.10 are direct results of the observed induced appreciations of the real exchange rate.

Figure 5.11. Impulse responses of RGDP and RNOGDP to a REXN shock



The response of RGDP to the real exchange rate appears larger and longer than it does for RNOGDP. Figure 5.12 shows the responses of these variables to themselves and RGDP appear to have more inertia than RGDP. This is plausible, especially with non-oil GDP expected to be more variable and thereby have less memory, as explained previously.

Figure 5.12. Impulse responses of RGDP and RNOGDP to an own shock



Nevertheless, the simulation results of these scenarios show that the increase in world oil prices can have an adverse impact on the real sectors through the exchange rate channel; this is viewed as the second sign of Dutch disease (Wijnbergen 1984; Krugman 1987; Harvie 1993; Valeriy et al. 2015). Due to a positive shock in world oil prices, more foreign exchange reserves would be generated, leading to an appreciation in the real exchange rate (see Chapter 3). This appreciation in the real exchange rate produces adverse consequences for the real non-oil sector by leading to loss of competitiveness of non-oil tradeable goods during the adjustment process in the short, medium and long term (Valery et al. 2015; Jahan-Parvar & Mohammadi 2012; Hasanov 2013).

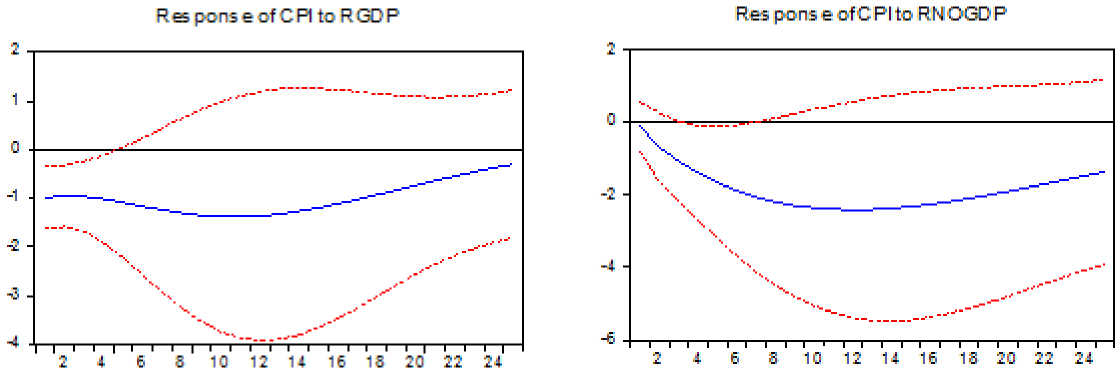
These results are consistent with the prior Johansen cointegration analysis reported in the appendix, particularly for the negative effect of the increase in the world oil price on RNOGDP in Model 2. The major difference is the permanent effects of Johansen do not carry through to the SVAR analysis. This is a positive aspect of SVAR, in that a one-period shock to world oil prices is not expected to have permanent effects. The dynamics of the SVAR in levels do not seem to suffer from not including the long-term cointegrating vector. Given the focus of this thesis is the short and medium runs, the SVAR dynamics over these periods are richer, more informative and plausible.

The final observation from Figures 5.10 and 5.11 is that the induced appreciation of the real exchange rate is not sufficient to offset the effects of the sustained increase in the world oil price on the domestic price level. This is different from the findings reported by Afandi (2005), Tang (2006) and Zaidi (2011), in which the appreciation channel generally leads to lower domestic prices due to lower demand for domestically produced non-oil tradeables. It is also argued that the appreciation could enhance supply and improve the competitiveness and performance of the non-oil tradeable sector and the non-oil trade balance overall (Ali & Harvie 2015a).

Figure 5.13 indicates that improvements in RGDP and RNOGDP lower domestic prices. Increasing RNOGDP by one standard deviation would lead to a relatively larger and longer reduction in the CPI. These results suggest that Dutch disease effects on prices due to world oil prices shocks can be mitigated through a boost in real non-oil output supply by reducing the gap between demand and supply (Nathan 2012; Aziz 2013, cited in Omolade & Ngalawa 2017).

Figure 5.13. Impulse responses of CPI to an output shock

Model 1 **Model 2**



Given these IRFs dynamically track the effects of an innovation in a selected variable on the other variables, it is also of interest to analyse the degree of variation in each variable, which is attributable to the innovation in the selected variable.

5.5.2 Variance decompositions

The VD procedure provides analysis of the relative importance of each innovation in affecting the other variables. More precisely, these decompositions indicate the proportion of the variance of each variable, attributable to the variance of shock in the selected variable (Morin & Stevens 2004; Alkahtani 2013; Sugiarto 2015). Tables 5.7.1 to 5.7.4 report the results of the VDs for Models 1 and 2 respectively. As for the IRFs, they are grouped into 1–5 periods (short run), 6–10 periods (medium run) and 11–25 periods (long run). The VDs by the Cholesky factor are dependent on the order of the variables in the SVAR matrix.

The first variable shown in Table 5.7.1 for both models, WROILP, has the largest decomposition in the first period because its variance is purely due to its own contemporaneous innovation. This variance dominates the other variables, accounting for around 95–100% of the variation in the short term, 90–95% in the medium term and a high 85–90% in the long term. This is a result of modelling Libya as a small economy that is significantly more affected by external factors, rather than changes in domestic variables (Adeleke 2014; Omolade & Ngalawa 2017).

Table 5.7.1

Variance Decomposition of World Oil Prices

	Model 1					**Model 2**			
Periods	WROILP	REXN	RGDP	CPI	Periods	WROILP	REXN	RNOGDP	CPI
1	100.0	0.0	0.0	0.0	1	100.0	0.0	0.0	0.0
5	95.6	0.2	4.1	0.0	5	95.5	0.1	3.9	0.4
10	89.6	0.5	9.7	0.0	10	93.6	0.2	4.9	1.2
15	86.8	2.3	10.6	0.2	15	91.5	0.8	5.9	1.7
20	85.1	4.3	10.3	0.2	20	89.3	1.9	6.9	1.8
25	84.5	5.2	10.1	0.2	25	87.5	2.9	7.8	1.7

For the innovation in the real exchange rate for Model 1 shown in Table 5.7.2, the variance is initially high in the first period, accounting for 98% of the variation. However, it falls relatively quickly to around 75% at the end of the short term for Model 1, to nearly 60% at the end of the medium term and to a little over 50% at the end of the long term. Most of this drop-off in the share of the variation is taken up by the variation in the world oil price. The reduction in relative importance is even clearer for Model 2. The variation attributed to the real exchange rate falls to around 50% at the end of the short run, 35% at the end of the medium run, levelling off at nearly 30% at the end of the long run. The relative importance in the long term is dominated by RNOGDP and shared with the world oil price.

Table 5.7.2

Variance Decomposition of Real Exchange Rate

Model 1					Model 2				
Periods	WROILP	REXN	RGDP	CPI	Periods	WROILP	REXN	RNOGDP	CPI
1	2.0	98.0	0.0	0.0	1	2.0	88.0	0.0	0.0
5	24.4	73.8	1.2	0.6	5	40.3	47.6	10.4	1.6
10	39.4	57.3	1.3	1.9	10	46.0	34.6	15.5	3.8
15	40.5	54.9	1.4	326	15	42.4	36.4	15.1	5.9
20	40.8	53.6	1.8	3.8	20	41.6	36.1	14.9	7.2
25	42.2	51.6	2.3	3.9	25	28.1	28.1	36.6	7.1

The variations in RGDP and RNOGDP in Table 5.7.3 are lower than for the first two variables over the three time periods. This is for both models and due to the lower ordering of these variables. Interestingly, the variation in RNOGDP is relatively less important than that in RGDP for all these periods. The real exchange rate becomes relatively more important than the output variables in the long run.

Table5.7.3

Variance Decomposition of Real GDP and Real Non-Oil GDP

Model 1					Model 2				
Periods	WROILP	REXN	RGDP	CPI	Periods	WROILP	REXN	RNOGDP	CPI
1	15.6	0.0	84.3	0.0	1	22.5	88.0	0.0	0.0
5	15.6	22.6	61.5	0.0	5	25.0	26.0	48.0	0.3
10	16.8	33.4	48.9	0.3	10	22.5	44.2	32.0	0.8
15	16.8	33.4	48.4	1.1	15	25.7	44.0	29.1	1.2
20	17.2	43.0	37.7	1.9	20	26.4	43.07	28.6	1.5
25	18.0	43.0	36.1	2.3	25	26.8	42.5	28.3	1.5

The variance in prices is again lower for Model 1, but higher than for RNOGDP and the real exchange rate for Model 2. However, Table 5.7.4 shows it deteriates quickly and is dominated by the world oil price even at the end of the short run, and by all variables in the medium and long term.

The interesting aspect of the VD for Model 2 is the dominance of the world oil price shock over all other variables for all 25 periods. The importance of the real exchange rate is next highest in the short run, but falls relatively faster and is less important than the world oil price in the medium run, and then less important than RNOGDP in the long run. RNOGDP also dominates in the short term, but is less important than the real exchange rate in the medium and long term. This reversal of relative importance of the real exchange rate and RNOGDP to their own shocks over the medium to long term is relevant. The variation of the real exchange rate, due to its own shock, is dominated over time by variation in RNOGDP. That is, RNOGDP responds increasingly to the dissipating real exchange rate shock. However, it takes most of the long term for this to happen. The reverse is true for the shock to the variation to RNOGDP being overtaken, over time, by the response in the variation to the real exchange rate. This latter response of the real exchange rate to the RNOGDP occurs more quickly.

Table 5.7.4

Variance Decomposition of Real CPI

Model 1					**Model 2**				
Periods	WROILP	REXN	RGDP	CPI	Periods	WROILP	REXN	RNOGDP	CPI
1	0.1	17.7	19.2	62.8	1	0.6	10.8	0.2	88.3
5	43.5	24.6	9.9	22.0	5	34.3	19.7	13.7	32.1
10	60.4	22.8	8.0	8.7	10	54.7	17.7	16.5	10.9
15	62.0	24.3	8.1	5.6	15	61.0	16.1	16.8	6.0
20	61.1	26.4	7.8	4.5	20	63.6	15.2	16.7	4.4
25	60.4	27.8	7.5	4.2	25	64.8	14.7	16.7	3.8

These looping dynamics form an interesting sling-shot interplay between the real exchange rate and RNOGDP. This further explains that the observed complex dynamics represented in their IRFs, along with the established dominance of the world oil price, certainly strengthens the dynamic intertemporal effects of Dutch disease for Libya.

5.6 Summary and Conclusions

The purpose of this chapter has been to test whether there are strong symptoms of Dutch disease that pose a threat to the Libyan economy. In doing so, it assesses the mechanisms through which fluctuations in the world oil price can lead to a deterioration in real output of the non-oil sector, and thus, the medium- and long-term prospects of real output in an economy that relies heavily on the oil sector.

This involves pretesting the available time series data for the key variables over 1980–2016, deciding not to manipulate the data and estimating the four variable VARs in levels. These results were used to determine the exactly indentified SVAR, with relationships specified according to the previously derived theoretical model.

The simulation analysis, using the IRFs, shows the existence of Dutch disease in Libya through the presence of the three main symptoms: the appreciation of the real exchange rate, the reduction in real output and an increase in domestic prices. A shock to the world oil price appreciates the real exchange rate in the short to medium term, which adversely affects real output, particularly in the non-oil sector over these periods. This ultimately overcomes the positive effect of the increased oil price on RGDP, forcing it to decline in the medium run.

The VD analysis confirms the importance of the world oil price and exchange rate mechanism. It also describes an accumulating feedback effect in which an own shock to either the real exchange rate or real non-oil output, while dissipating over time for that variable, feeds through to increasing effects of the other variable over the medium to long run.

The role of domestic prices requires further exploration. The IRFs show that the world oil price shocks increase domestic prices in the short, medium and long term. Nonetheless, the appreciation of the real exchange rate does not effectively reduce prices. There is preliminary evidence that indicates the possibility of reducing prices by increasing real output, or at least countering the decline in output.

In this regard, possible macro-economic policy responses need to be considered, in particular, how to offset the adverse effects of world oil price shocks on the domestic economy. If oil prices remain high in the future, the real exchange rate will continue to appreciate, placing further pressure on the non-oil sector. To this end, policymakers would be well advised to implement measures specifically aimed at mitigating Dutch disease effects. This is especially true given Corden's (2012) argument for the need for contractionary fiscal policy by moving the fiscal budget towards surplus and expansionary monetary policy to reduce domestic interest rates. These policies will reduce the appreciation of the exchange rate and the adverse effects of the Dutch disease on real output and prices. These important aspects will be considered in Chapters 6 and 7.

Chapter 6: World Oil Price Shock and Macro-Economic Policy Responses

6.1 Introduction

As discussed in Chapters 2 and 3, world oil prices have increased significantly, causing global shocks with stagflationary macro-economic implications for many oil-exporting developing countries in the MENA region, including Libya (Mahmud 2009; Ahmouda 2014; Adeleke 2014; Mahmud 2009).

The dynamic analysis in Chapter 5 detected Dutch disease symptoms of a positive world oil price shock for Libya in 1980–2016. While the effects of the shock initially increased real output in the short term, it also appreciated the real exchange rate and reduced real non-oil output in the short to medium term. This reduction in real output not only offset the initial short-term increase, it was sufficient for it to fall in the medium term. The domestic price also increased over the short to long term, indicating that the appreciation of the real exchange rate does not effectively reduce the domestic price. However, increasing real output, or at least countering its decline, reduces upward pressure on price. The VD analysis shows the central importance of the mechanism between real exchange rate and real non-oil output over the medium to long term.

Chapter 5 concludes the need to analyse possible macro-economic policy responses to mitigate the adverse effects of Dutch disease. This chapter will do this using Corden's (2012) recommendation to reduce the domestic interest rate to offset the appreciation of the real exchange rate. He recommended that this be done through contractionary fiscal policy to move the fiscal budget towards surplus, and second, through expansionary monetary policy. These policies require additional variables and the replacement of other variables, which will also test the robustness of the Dutch disease findings in Chapter 5.

Many factors contribute to the extent of the initial impact of a world oil price shock and its transmission within an economy over time (Barsky et al. 2002; Hamilton 2003, 2004: Mahmud 2009). The shock can have contemporaneous effects through to temporary effects that only influence the economy in the short to medium term, up to permanent effects in the long term. The dependency of the Libyan economy on oil means that any shocks to the world oil price, and importantly, the extent of macro-economic policy responses to the shock, will involve lags. Analysis of these dynamic contemporaneous and lagged effects justify using the SVAR methodology, including IRFs and VD. This procedure can create a picture of the transmission mechanisms of the adverse effects of the world oil price shock and possible alternative macro-economic policy responses in Libya. An effort will be made to identify the system of equations in the SVAR models based on the theoretical model developed in Chapter 4.

The chapter has two principal parts that analyse the world oil price shock: a fiscal policy response in Section 6.2 and a monetary policy response in Section 6.3. Section 6.4 will offer conclusions.

6.2 Part A: World Oil Price Shock and Fiscal Policy Response

This part extends the Dutch disease model used in Chapter 5 to include a fiscal policy framework. This section elucidates the context of Libyan fiscal policy and the main considerations for a model, followed by the SVAR specification and identification, and finally, empirical estimation and dynamic analysis.

It is imperative to understand Libyan fiscal policy more deeply prior to utilising the SVAR model. This will enable greater understanding of important assumptions and considerations that relate to the specified model, which will lay a foundation for the dynamic analysis of this section.

6.2.1 The context of Libyan fiscal policy and the main considerations for a SVAR model

As mentioned previously, the lack of focus on monetary policy has rendered fiscal policy the primary instrument in achieving the macro-economic goals necessary for economic development in Libya (Alimohamed 2014). However, fiscal policy has not successfully managed the nation's macro-economic problems, which include falling RGDP growth and increasing inflation.

An important consideration for fiscal policy is Libya's reliance on oil revenue as its main source of budgetary financing (Ahmouda 2014). As explained in Chapter 2, around 80% of total public revenue came from oil sales in 1980–2016 (World Bank 2016). This reflects the importance of oil in the Libyan economy and within an extremely underdeveloped tax system (Yahia & Saleh 2008; Fargani 2013). Oil revenue is denominated in foreign currency and under a managed exchange rate; these inflows are equivalent to increasing the domestic money supply. This makes fiscal policy very effective. However, this has not eventuated in terms of increasing real output in Libya. Rather, it has been argued that the monetary accommodation of the fiscal budget has been achieved at the expense of increased domestic prices (Ali 2011; Fargani 2013; Bekhet & Mohamed 2013; IMF 2014a; Ali & Harvie 2015a). Further, the fiscal dependence on highly variable oil revenue, due to the instability of the world oil price, has negatively affected the efficacy of fiscal policy. The fiscal budget deficit and its dependence on oil revenue have been considered major issues in Libya. These factors will be analysed in terms of the world average oil price (WOILP) and real fiscal budget balance (RFSB) variables included in Table 6.1.

Increasing the fiscal budget deficit according to the twin deficit hypothesis will lead to an increase in the current account deficit (Bernheim 1988; Lizondo & Khan 1987; Merza et al. 2012; Arjomand et al. 2016). An increase in public spending that stimulates domestic consumption and income will flow through to increased spending on foreign goods and services. The increase in imports leads to a deficit in the trade balance, which transfers to the current account. The usual twin deficit explanation (Cox & Harvie 2010), in which the bond financing requirement of the budget deficit increases the domestic interest rate and appreciates the nominal exchange rate, is less relevant for Libya and its undeveloped government bond markets. Rather, the flow to import spending is exacerbated by the increase in domestic prices due to the monetary accommodation of the budget deficit. Since the nominal exchange rate is managed in Libya, the higher domestic prices (especially of manufactured and other tradeable non-oil products) lead to an appreciation in the real exchange rate, worsening the trade balance (Adeleke 2014; Omolade & Ngalawa 2017). The resulting decline in non-oil exports and increase in imports, reducing the real non-oil trade balance (RNOTRD), lead to lower growth in real non-oil output. This, of course, is the Dutch disease effect, discovered in Chapter 5.

Finally, the impact of oil prices on the RNOTRD is assumed to be directly affected by the real effective exchange rate (REXMP). The REXMP includes the impact of the real exchange rate and the import price index (IMF 2013). It captures the effects of changes in the real exchange rate[39] and in the price of imported goods. An appreciation in the real exchange rate and higher price for imports can deteriorate the RNOTRD; this leads to lower RNOGDP.

In summary, an increase in the world oil price can inflict the Dutch disease effect by appreciating the real effective exchange rate, which reduces RNOTRD and RNOGDP. This effect is in addition to the twin consequences of the fiscal budget deficit on the real non-oil trade deficit. Therefore, the empirical model in this section will test the existence of a twin deficit issue in the Libyan economy and how this relates to Dutch disease. It will explore the extent to which a movement of the fiscal budget towards a surplus can offset the real appreciation and adverse impact of Dutch disease, as Corden (2012) suggested.

The model will now be specified using the variables detailed in Table 6.1. The RFSB is expressed as the overall difference between real government revenues (including taxes and other revenue received by government) and real total government spending. A positive (negative) balance implies a surplus (deficit) in the government budget (Central Bank of Libya 2018). As explained previously, the REXMP includes the real exchange rate

[39] Real exchange rate in this case is a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs (IMF 2019).
http://datahelp.imf.org/knowledgebase/

and import price index. It uses a trade weighted average of several foreign currencies, divided by a price deflator or index of costs (IMF 2013). Since it is the real domestic price of foreign exchange, a reduction (increase) in its value is a real appreciation (depreciation). The RNOTRB is the difference between exports and imports (World Bank 2017, 2018). All real variables, including RNOGDP, are in constant LYD 2010 prices. The CPI is based on 2010.

Table 6.1
Description and Sources of Data for Chapter 6A

Variable	Description	Math notation	Source
WROILP	World average oil prices (US$ per barrel)	po_t	WB-OPEC
RFSB	Real fiscal budget balance (million LYD, constant LYD 2010 prices)	$-bd_t = \tau_t^x - g_t$	WB-CBL-IMF
REXMP	Real effective exchange rate (million LYD constant 2010 prices)	er =(e_t+ $p_t^n - p_t$)	WB-IMF
RNOTRD	Real non-oil trade balance (million LYD constant 2010 prices)	NTB_t	CBL-IMF-WB
RNOGDP	Real non-oil GDP (million LYD constant 2010 prices)	No_t^s	WB-CBL
CPI	Consumer price index (2010 = 100)	p_t	WB-CBL

Source: WB = World Bank Annual Report, 2000, 2006, 2016, 2017, 2018.
OPEC = Organization of the Petroleum Exporting Countries, 2016, 2017, 2018, May 2019.
IMF = International Monetary Fund, IMF 2006, 2013 IMF 2016, https://data.imf.org
CBL = Central Bank of Libya 2010, 2014, 2016, 2018 various issues.

6.2.2 The SVAR specifications and identification

This section presents the specifications and identification schemes for the SVAR model that demonstrates the contemporaneous and dynamic relationships among the selected variables of the model. It extends the Dutch disease model analysed in Chapter 5 by adding the balances of the real fiscal budget and real non-oil trade. The real effective exchange rate replaces the real exchange rate since it is a more relevant measure to examine the effect on the trade balance. These new variables will also indicate the degree of robustness of the finding of Dutch disease in Chapter 5. The model will be used to investigate the impacts of the world oil price shock and fiscal policy response on the included key macro-economic variables in Libya.

The SVAR comprises the A_0X_t matrix with the variables listed in the X_t vector, from the most exogenous at the top to the most endogenous at the bottom. These assumed relationships are extracted from the theoretical equations explained in Chapter 4. They focus on three sectors of the theoretical model: the product market with the fiscal budget and fiscal policy channel, the external sector and the domestic macro-economic objectives of real output and price (see Sections 4.3.1.1, 4.3.1.3 and 4.3.1.4). These three sectors are more related to the analysis of fiscal policy response to a world oil price shock. However, minor modifications to the theoretical model were necessary to employ the SVAR model to the economy of Libya, for which some data are unavailable and some markets are only developing.

$$A_0X_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} WROILP_t \\ RFSB_t \\ REXMP_t \\ RNOTRD_t \\ RNOGDP_t \\ CPI_t \end{bmatrix}$$

The WROILP is treated as an exogenous variable in the recursive system so that a shock to it contemporaneously affects all other variables, but is not contemporaneously determined by them. The shock in the world oil price is assumed to solely influence the RFSB contemporaneously with the affected determined by the coefficient a_{21}. As discussed previously, the induced foreign exchange inflow from the additional oil export receipts fund the RFSB. This balance is the negative of Equation (4.10)—that is, the difference between real tax revenues (T_t^x) and real government expenditure (g_t): $-bd_t = T_t^x - g_t$ Tax revenues are generated from two sources, oil production and non-oil production, as per Equation (4.11).

$$T_t^x = \sum_{i=1}^{K} a_{51}^i(o_{t-i}^a + po_{t-i} + er_{t-i}) + \sum_{i=1}^{K} a_{52}^i No_{t-i}^s \qquad 4.11$$

The tax revenue generated from oil is determined by $(o_t^a + po_t + er_t)$, where o_t^a is oil production, po_t is the world oil price, $er_t = (e_t - p_t)$ is the real exchange rate and a_{51} is the tax rate. The tax revenue from non-oil production is No_t^s, and the tax rate is a_{52}. As explained in Chapter 2, the tax revenue of the non-oil sector only represents a fraction of total tax receipts, around 5% (IMF 2016). This is because of the undeveloped system of taxation in Libya (Joharji 2009; Alkahtani 2013). The majority of fiscal budget revenues are generated from the tax on oil, so these revenues closely follow the path of the world oil price and subsequent oil sales receipts (Ali 2011; Alimohamed 2014; World Bank 2016). This is problematic, and as discussed in Chapter 2, the Libyan fiscal budget has been adversely influenced by a reduction in oil exports and revenue, which started in 2011 (IMF 2013). Revenues from the oil sector declined by 54% from 2010–2014. However, the level of fiscal spending increased and remained at about 59.7%, mainly due to the appointment of new public officials (World Bank 2016).

Therefore, in most cases, researchers of developing countries focus on government spending rather than taxation as the instrument of fiscal policy. However, this research will focus on the revenue from the oil sector being the main source of public spending funds in Libya. These two sides of government spending and tax revenue are captured by the budget deficit and how it is financed. The budget deficit (bd_t) can be financed in three ways: money creation (Cox & Harvie 2010), borrowing domestically from the private sector and/or borrowing from abroad (Romer 1983).

In Libya, the budget deficit is financed predominantly through money accommodation (sales of government bills and securities to the CBL). The government only issues bonds to the central bank, not to the public, since there is no government bond market (Central Bank of Libya 2010; Libyan National Authority for Information and Documentation 2015). The Libyan government has not yet borrowed from abroad (Ali & Harvie 2015). Therefore, this study assumes that the budget deficit is financed through monetary accommodation and oil sales revenue. Equation (4.12) captures these two funding sources:

$$bd_t = c_6 + \sum_{i=1}^{K} a_{61}^i (m_{t-i}^S - p_{t-i}) + \sum_{i=1}^{K} a_{62}^i (o_{t-i}^x + po_{t-i} + er_{t-i}) \qquad 4.12$$

Monetary accommodation through borrowed CBL funds results in an expansion of real money supply $(m_t^S - p_{t)})$. The role of oil exports in financing the fiscal budget is also included in terms of foreign receipts from government-owned oil sales $(o_t^x + po_t + er_t)$ (IMF 2013).

In this model, the RFSB variable is used instead of separate government spending and taxation variables, as per the theoretical model in Chapter 4. The SVAR model captures these two aspects of fiscal policy in one real fiscal budget channel. While this keeps the model simple, there are other reasons to use the real fiscal budget as a proxy for the fiscal policy channel. First, the use of the RFSB variable avoids the issue of insufficient taxation information, which is the main concern for many researchers in developing countries (El Anshasy & Bradley 2012; Khan & Mezran 2013; IMF 2016). Researchers of developing nations often only consider one side of the budget due to a lack of available data. This can be a serious issue for the estimated fiscal coefficients, and results in ambiguous results. Second, as explained previously, there is a strong linkage between government spending and the government's financing techniques over longer periods in debt-limited developing countries (World Bank 2006; Sadeghi 2017; El Anshasy 2012; El Anshasy & Bradley 2012). Third, the use of the RFSB allows direct testing of Corden's (2012) suggestion to alleviate Dutch disease effects through fiscal budget surpluses.

The RFSB is assumed to be solely influenced by the world oil price shock, with the SVAR coefficient a_{22} in the A_0 matrix indicating the size of this effect. The A_0 matrix also shows that the zero restriction on the other side of the diagonal means that RNOGDP does not influence the RFSB in this model. This reflects the lack of contribution of non-oil taxation to the Libyan economy. The fiscal budget is assumed to largely follow the path of oil prices, so it is placed second after world real oil prices. The fiscal budget channel assumes to influence the main factors of Dutch disease—the REXMP and real trade balance, and ultimately, RNOGDP and the domestic price level.

The REXMP, defined as $(e_t + p_t^n - p_t)$, is placed in the third row of the SVAR model since it is the next variable to be influenced by the world oil price shock. The foreign exchange inflow resulting from increased oil export receipts appreciates the REXMP. This appreciation will increase the price of exports denominated in foreign currency and reduce the domestic price of imports compared to domestically produced goods (Ozata 2014). The real appreciation, shown as a reduction in er_t in in Equation (4.28), will reduce the size of the domestic value of the foreign exchange receipts, and thus, the real trade balance (TRB_t).

$$TRB_t = c_{16} + \sum_{i=1}^{K} a_{161}^{i}\, po_{t-i} + \sum_{i=1}^{K} a_{162}^{i}\, o_{t-i}^{x} + \sum_{i=1}^{K} a_{163}^{i}\, Eer_{t-i} + \sum_{i=1}^{K} a_{164}^{i}\, (No_{t-i}^{x} - No_{t-i}^{m}) \tag{4.28}$$

The SVAR model considers the real trade balance rather than the current account of the BoP, also developed in the theoretical model in Chapter 4. According to the CBL (2010), the real trade balance represents a key component of the Libyan current account. Hence, the real trade balance makes a significant contribution to the balance of the payments. The trade balance, and most especially the exportation of oil, is believed to be the primary determinant of the current account since oil prices have a significant impact on the country's total exports and the issues posed by an oil-based economy (Ali-Mohamed 2014; World Bank 2016). However, the appreciation will also worsen the non-oil tradeables, with lower exports and higher imports. The RNOTRD given by ($No_t^x - No_t^m$) in Equation (4.28) will also worsen. This section focuses on the RNOTRD instead of the real trade balance because it is closely related to Dutch disease. Therefore, the RNOTRD is included in the fourth row of the A_0 matrix, being contemporaneously affected by the world oil price, RFSB and REXMP.

The real non-oil trade balance will in turn affect demand for real non-oil output, as shown in Equation (4.1):

$$No_t^d = c_1 + \sum_{i=1}^{K} a_{11}^{i}\, con_{t-i}^{p} + \sum_{i=1}^{K} a_{12}^{i}\, i_{t-i}^{p} + \sum_{i=1}^{K} a_{13}^{i}\, g_{t-i} + \sum_{i=1}^{K} a_{15}^{i}\, (No_{t-i}^{x} - No_{t-i}^{m}) \qquad 4.1$$

The effect of the RFSB is proxied via real government spending (g_t), which comprises a weighted average of both government consumption and government investment spending. The RNOGDP variable is placed fifth in the A_0 matrix, being affected by all variables in the rows above it.

The domestic price (CPI) variable is placed last, being the most endogenous of the six variables. The domestic price index p_t is defined in Equation (4.24) and is affected by the domestic currency price of oil $(e_t + po_t)$ and the domestic currency price of the imported non-oil good:

$$p_t = c_{13} + \sum_{i=1}^{K} a_{131}^{i} w_{t-i} + \sum_{i=1}^{K} a_{132}^{i} (e_{t-i} + po_{t-i}) + \sum_{i=1}^{K} a_{133}^{i} (e_{t-i} + p_{t-i}^{n}) \qquad 4.24$$

Equation (4.25) shows the wage rate (w_t) in (4.24) is also affected by the price of oil (po_t), any difference between demand and supply of real non-oil output $\left(No_t^d - No_t^s\right)$ and inflationary expectations (π_t^e).

$$w_t = c_{14} + \sum_{i=1}^{K} a_{141}^{i} \left(No_{t-i}^{d} - No_{t-i}^{s}\right) + \sum_{i=1}^{K} a_{142}^{i} \pi_{t-i}^{e} + \sum_{i=1}^{K} a_{143}^{i} po_{t-i} \qquad 4.25$$

So, the world oil price shock po_tenters via Equations (4.24) and (4.25), and the RFSB via the induced foreign exchange inflow $(e_t + po_t)$ in Equation (4.24). The REXMP effect is via $(e_t + p_t^n)$ in (4.24) and the RNOTRD is via $\left(No_t^d - No_t^s\right)$ in (4.25) and the exchange rate variables in Equations (4.24) and (4.25).

These variables clearly also affect real non-oil output No_t in many ways, and will not be detailed here. Similarly, the world oil price shock will also feed through to inflationary expectations π_t^e in Equation (4.25) and subsequently to the domestic price level in Equation (4.24). It will be left to the SVAR dynamics to indicate these many and complex interconnections, relating to Dutch disease and price effects.

The final point to consider is the potential for an upward spiralling price level. This reflects the caution by experts, including the IMF (2008), Ruhaet (2010) and African Development (Bank 2017) that a substantial increase in net foreign assets from oil exports increases money supply and public spending, moving the real fiscal budget into further deficit. Due to the limited scope of monetary policy and the importance of fiscal policy, these effects lead to continued upward pressure on the domestic price level (Ruhaet 2010; African Development Bank 2017). The price increases further appreciate the REXMP via the relationship $(e_t + p_t^n - p_t)$. This is especially true, with Libyan authorities managing the nominal exchange rate so that differences in relative prices force adjustment in the real exchange rate (Adeleke 2014; Ali & Harvie 2017; Omolade & Ngalawa 2017; African Development Bank 2008, 2017). The real appreciation is expected to promote Dutch disease effects on real non-oil output.

Much of this feedback would require dropping some zero restrictions in the upper triangular area of the A_0 matrix. However, due to the identification requirements, these are forced to zero. It is crucial to note that these identification restrictions only stop contemporaneous effects occurring; the important lagged feedback effects still occur in the SVAR system.

As in Chapter 5, the $B\varepsilon_t$ residuals matrix is assumed to be unrestricted diagonal, forcing the contemporaneous shocks to each variable to only occur via its own equation. This is important for consideration of the world oil price shock, which effects each variable and their equation, not by their respective residuals, but contemporaneously via the world oil price variable in each structural equation.

$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix}$$

The model is exactly identified with the presence of 21 + 30 = 51 restrictions imposed on matrices A_0 and B. Using the formula, $2n^2 - n(n + 1)/2 = 51$, restrictions for the $n = 6$ included variables. Sections 6.2.3–6.2.4 will test these assumptions through estimation and simulation analysis of the SVAR model for the world oil price shock and fiscal policy response.

6.2.3 Estimation

The specified six-variable SVAR is estimated using EViews 8 software with available yearly time series data over 36 years (1980–2016). Data pre-estimation is essential to ensure the accuracy of the empirical estimation. The optimum VAR lag length is determined according the selection criteria, and Table 6.2 shows that all criteria select a lag of 1 at the 5% level of significance. The residual test in Table 6.3 shows no serial correlation in the residuals with this lag at the 5% level. The joint test (not reported here) indicates there is no heteroscedasticity in the residuals also at the 5% level. However, the joint test of normality shows some non-normality present, with three of the six components suffering from kurtosis, although only one is skewed at the 5% level of significance.

Table 6.2

VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	–543.58	NA	304000.09	33.19	33.36	33.25
1	–382.13	273.97	405643.5**	24.21**	25.28**	24.68**
2	–363.43	27.19**	455673.4	24.37	25.84	24.76
3	–354.99	10.22	725933.3	24.66	27.02	25.46
4	–331.70	22.58	602875.7	24.22	27.31	25.26

Notes: * indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table 6.3

Residual Serial Correlation Test

Lag	LM-Statistic	Probability
1	15.47	0.49
2	5.70	0.99
3	8.42	0.93
4	26.82	0.04

Note: Null hypothesis is no serial correlation with VAR lag order 1.

The model satisfies the stability condition, with each of the estimated eigenvalues less than 1, with four indicating damped oscillating dynamics (see Table A6.1 in the Appendix 6A). As explained in Chapter 5, the model is tested for stability to ensure all variables in the model collectively converge to a steady state in the long run (Zaidi 2011). This is because the focus here is the stable dynamics of the system, instead of testing each variable for stationarity and imposing further restrictions on their specifications, which may obscure the dynamic transmission of the world oil price shock and fiscal response.

The SVAR results are reported in Appendix 6A, Table A6.2. As for Chapter 5, SVAR estimates need to be treated with caution since the true distributions are not known, especially in non-large samples. Thus, the estimates show that in responding to the positive world oil price shock, the real fiscal budget moves in a surplus direction, the REXMP appreciates, deteriorating the RNOTRD and RNOGDP. The world oil price shock also increases the domestic price level. These results, while differing in magnitude, are remarkably consistent across the VAR and SVAR procedures in terms of the direction of the effects. They are also as expected according to the theoretical model discussed in the previous section and add further evidence to Dutch disease, discovered in Chapter 5. Given the danger of focusing on individual point estimates and their confidence intervals, the dynamics of Dutch disease effects will now be explored, along with Corden's (2012) suggestion to offset these effects using fiscal policy.

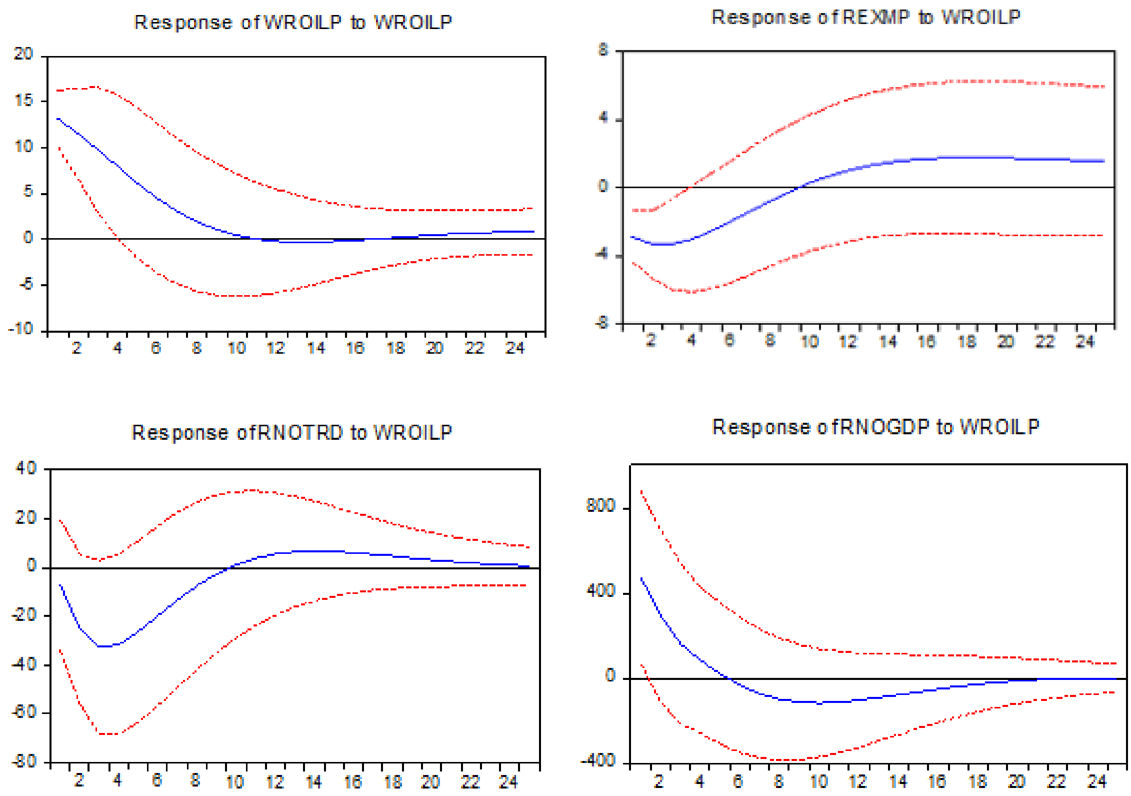
6.2.4 Simulations

This section presents three frameworks to investigate the dynamic responses of the variables to a world oil price shock. The first simulation analyses the IRFs of the key macro-economic variables to explore the dynamic the existence of Dutch disease. The second simulation simultaneously investigates the responses of the real non-oil trade and the RFSB to the oil price shock. It is designed to test for the existence of the twin deficits relationship between real non-oil trade and the real fiscal budget. Associated with this is the exploration of the CPI response to a change in the real fiscal budget under the oil price shock. The third simulation examines the response of the REXMP to the real fiscal budget surplus and the subsequent impact on RNOGDP and inflation. This will test the first suggestion of Corden (2012) to alleviate Dutch disease impacts. All simulations have been operated under the current managed nominal exchange rate regime in Libya.

6.2.4.1 First simulation: Presence of Dutch disease.

The first of the four IRF graphs in Figure 6.1 shows how the one-off first period positive shock to the WROILP continues over time due to the lags in the model. While diminishing, it returns to zero only in the medium term. The REXMP responds to the world oil price shock by appreciating in the short term. The RNOTRD accordingly moves into deficit during this period, with the relatively larger effect occurring in the first five periods.

Figure 6.1. Impulse responses to a world oil price shock



The RNOTRD deterioration is convincingly explained by the appreciation in the REXMP. This is caused by the decline in the non-oil exports, which become relatively expensive, and the increase in the more competitive non-oil imports (Ghanem 1987; Central Bank of Libya 2006; Ali 2011; Alimohamed 2014). The higher real income generated by exporting oil at higher oil prices results in increased demand for non-oil sector goods, including non-oil imports, as a result of their lower cost compared with domestic products. The combination of both lower non-oil exports and higher non-oil imports leads to the deficit in non-oil trade in Libya. Researchers (Khan & Mezran 2013; African Development Bank 2017) agree that Libya's RNOTRD growth is derived from increased importation of consumer and intermediate goods, which experience lower prices due to the real appreciation during the short, medium and early long term. Consequently, the continuing increments in the volume and value of non-oil sector imports above the exports of the domestic non-oil sector over a long period result in a real non-oil trade deficit (Ali 2011; Ahmouda 2014; Ozata 2014).

The initial world oil price stimulus to RNOGDP diminishes over this five-period interval and becomes negative. This is further evidence of the Dutch disease found in Chapter 5. Importantly, there are additional external and fiscal variables in this model, plus a different exchange rate measure, and yet this effect is still obvious. This adds to the robustness of the Chapter 5 finding of Dutch disease in the Libyan economy.

Note the RNOTRD improves in response to the depreciation in the REXMP in the late medium to long term. This implies that the RNOTRD can experience a surplus due to an improvement in non-oil exports and a decline in non-oil imports through depreciation in the REXMP. Therefore, real non-oil output will improve, although the reversal is relatively minor and occurs only in the middle to long term. This result is consistent with the theoretical literature on the real exchange rate and current account effects of Dutch disease (see Chapter 3). The literature tends to emphasise the role of the nominal and real exchange rates and the current account in transmitting the effects of oil prices shocks (see Chapter 3).

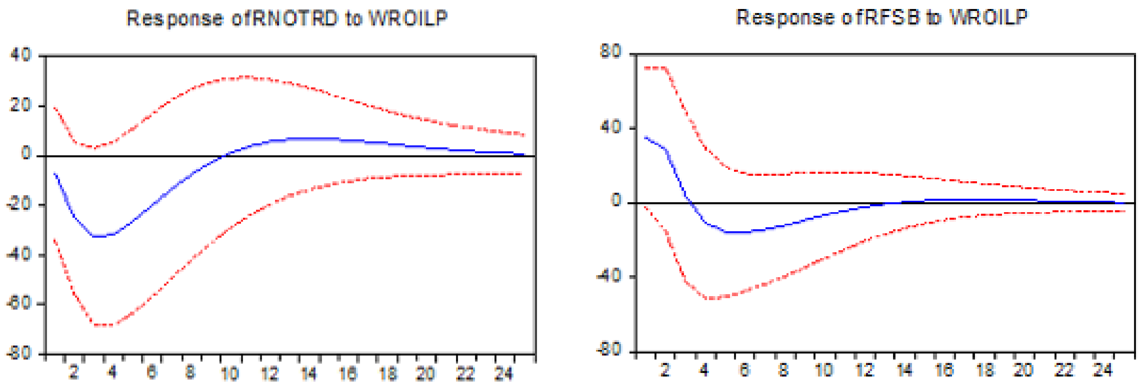
6.2.4.2 Second simulation: Twin deficits and price level

The simulations in Figure 6.2 show the response of RFSB to the oil price shock. As explained previously, the foreign exchange inflow from the higher oil sales revenue can be used to finance real fiscal spending, which reduces the real budget deficit. Figure 6.2 demonstrates that the RFSB went into surplus due to the oil revenue effect from the world oil price shock. However, it remained positive for only the first few periods, then declined quickly into a deficit in the short term; it remained in deficit until it returned to steady state balance in the medium term. The decline in the RFSB may be due to induced increases in fiscal spending, exceeding what can be financed by oil revenue. Given the world oil price declines over the short to medium term, the revenue effect will also decline and money creation may be required to fund the emerging deficit.

These effects have been also explained by Fargani (2013), Alimohamed (2014) and World Bank (2009, 2016). An ongoing deficit in the Libyan fiscal budget, influenced by higher oil revenue, resulted in higher government spending on consumption rather than investment. While the effects of the composition of government spending on real non-oil trade and RGDP will be analysed in Chapter 7, it is clear that a fiscal budget deficit will occur since expenditure exceeds non-oil revenue. When government spending involves higher spending on foreign goods, it causes a decrease in the RFSB and exacerbates the real non-oil trade deficit (Alkswani 2002; Merza et al. 2012).

As explained above, the impact of a positive oil price shock also leads to a decline in the RNOTRD. Figure 6.2 illustrates the simultaneous occurrence of the RFSB deficit and trade deficit—that is, the twin deficits—over the short to medium term.

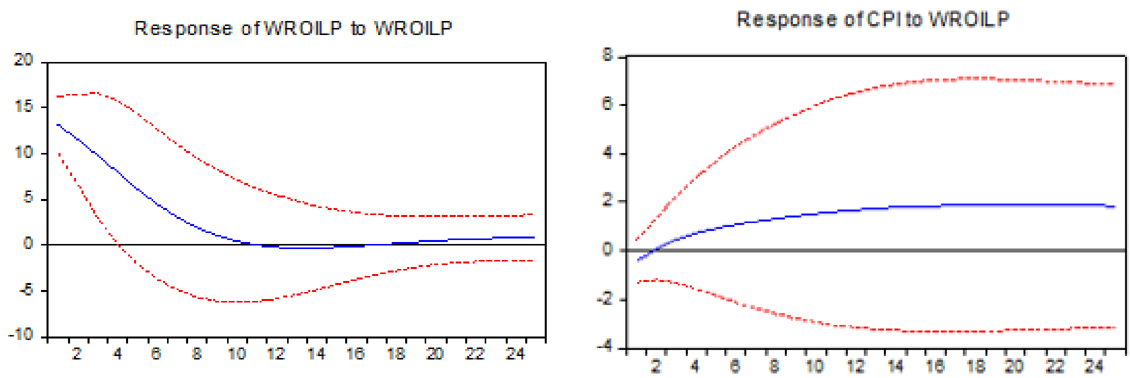
Figure 6.2. Impulse responses of the real non-oil trade and fiscal budget balances



This correlation between the two deficits under a world oil price shock indicates that the twin deficits hypothesis can coexist in with Dutch disease in Libya. This pattern is consistent with other oil-exporting countries of MENA, such as Kuwait, Saudi Arabia and Bahrain. Merza et al. (2012), Alkswani (2002) and Al Khalifa (2015) found a strong correlation between the deficit in the current account and the fiscal budget balance.

The increase in the world oil price unsurprisingly results in higher domestic price levels, as shown in Figure 6.3. The CPI increases at a declining rate, consistent with the declining world oil price, and levels off in the medium term, when the world oil price is back to zero. In doing so, the CPI moves to an apparently higher steady state. This coincides with the REXMP possibly remaining at a depreciated steady state, as indicated in Figure 6.1. The most likely reason for this is that higher domestic prices place pressure for a depreciation of nominal and real exchange rates. The additional pressure to increase the CPI over this interval coincides with the fiscal deficit in the medium term. This deficit increases the price level because it is funded by money creation, and spends more on public consumption than it does on public investment, adding more to aggregate demand rather than aggregate supply.

Figure 6.3. Impulse response of the CPI to a world oil price shock



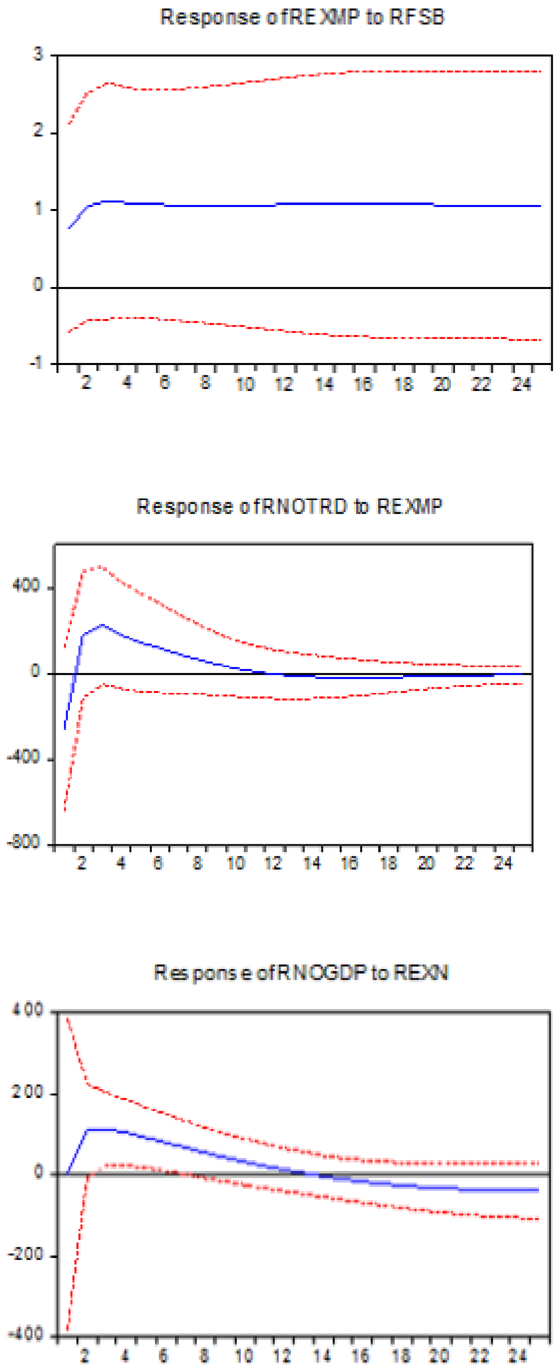
The next simulation will investigate the effects of a surplus in the real fiscal budget on Dutch disease and twin deficits.

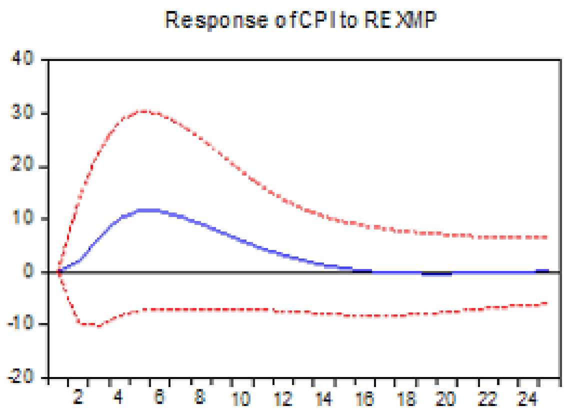
6.2.4.3 Third simulation: Impulse responses to a fiscal budget surplus

This simulation explores, under the current managed nominal exchange rate regime in Libya, Corden's (2012) first suggestion to move the real fiscal budget in a surplus direction. This is to mitigate Dutch disease effects of the world oil price shock by offsetting the REXMP depreciation and worsening RNOTRD. This occurs by lowering the economy's imports of cheaper products. This can enhance non-oil sector exports, and thereby, the country's trade balance, raising non-oil sector GDP (Corden 2012). The fiscal budget surplus, together with an improvement in RNOGDP, can also reduce higher domestic prices (Adeleke 2014; Omolade & Ngalawa 2017; African Development Bank 2017). While a surplus itself is not required, movement in the surplus direction by reducing the real budget deficit will hopefully mitigate the adverse effects on RNOGDP.

Figure 6.4 demonstrates the depreciating nominal exchange rate offsets the Dutch disease effects. Indeed, real non-oil trade balance and real non-oil GDP move quickly to steady state. These results are consistent with the those obtained from studies of other oil-exporting developing countries (Burment & Dincer 2004; Mamhumd 2009; Rima et al. 2013). It also demonstrates how to fix the twin deficits problem by moving the budget deficit towards a surplus which then pulls the non-oil trade deficit in the same direction.

Figure 6.4. Impulse responses to a real fiscal budget surplus and exchange rate depreciation.





However, achieving a fiscal budget surplus is difficult in Libya, particularly with its underdeveloped taxation system limiting increases in revenues. Policymakers need to examine the fiscal expenditure mix, particularly between government consumption and investment spending. This will be considered in the Chapter 7. The effects on the price level are ambiguous; they will be further considered in Section 6.3, which focuses on the world oil price shock and monetary policy responses.

6.3 Part B: Oil Price Shock and Monetary Policy Response

The aim of this section is to show how the oil price shock affects the domestic economy and how monetary policy may respond. The study modifies the previous SVAR model to include a monetary policy framework. Two important considerations are needed to successfully model the SVAR. The first is an understanding of the monetary policy environment of the Libyan economy and the second is the theory, which provides the framework for the interpretation of the relationships among variables in the model.

Section 6.3.1 considers the context of Libyan monetary policy and the main considerations of the economy for the model. This complements the information in Chapter 2. Section 6.3.1 specifies and identifies the SVAR model based on the theory explained in Chapter 4. The dynamic empirical SVAR analysis follows in a similar format to that used in Section 6.2.

6.3.1 The context of Libyan monetary policy and the primary considerations for a SVAR model

Monetary policy is the responsibility of the CBL and its main aim is to maintain domestic price stability (Central Bank of Libya 2016). However, the CBL is not independent of government (IMF 2008; African Development Bank 2017) and is committed to maintaining financial stability and encouraging conditions to support stable economic development (Central Bank of Libya 2014). As such, these goals—including increasing per capita income and financing the fiscal budget—are influenced by the external sector, and in particular, oil price shocks. Monetary policy needs to counter adverse effects (e.g., financing the fiscal budget through monetary accommodation raises money supply and the domestic price level) (Central Bank of Libya 2010; Adeleke 2014; see also Chapter 2). The upward pressure on price is amplified with a limited response of domestic interest rates to constrain aggregate demand and if the supply response is limited (Mahmud 2009; Cevik & Teksoz 2014).

Another important consideration is that Libya is an open economy. According to the monetary model of the balance of payments, foreign interest rates are important transmission mechanisms via the capital account. The US federal funds rate (FFR) is a suitable proxy for the foreign interest rate based on the significant economic and financial impacts of the US rate on many countries, including Libya (Zaidi 2011). The official NEXR is denominated in US dollars, expressed as units of domestic currency, LYD, per a unit of US currency (World Bank 2016; Central Bank of Libya 2014). An increase in the value of this rate is a depreciation of the domestic LYD against the US$. More LYD are required to purchase US$ and fewer US$ are required to purchase LYD.

The CBL has the ability to control the exchange rate and utilises a 'crawling peg' to do this. However, the currency value is allowed to fluctuate within a limited range, and the bank is unable to make large adjustments that breach the band limits on the rate (Jakob 2016). Such systems provide an intermediate degree of autonomy for a central bank; hence, the Taylor rule in monetary policy is excluded from this model. (The Taylor rule will be considered in the policy recommendations in Chapter 7.)

These new variables are included in Table 6.4, along with the previously defined variables of world oil price (WOILP), RNOGDP and the CPI. The other new variables included in Table 6.4, relevant to the analysis of monetary policy, are the domestic nominal interest (NDISRATE) and money supply (NMONS). The interest rate is the discount rate between the CBL and Libyan commercial banks (Central Bank of Libya 2010) and the nominal money supply is the M2 measure. These variables, along with the nominal exchange rate, are important.

Table 6.4

Description and Sources of Data for Chapter 6B

Variable	Description	Math Notation	Source
WROILP	World average oil prices (USD per barrel)	po_t	WB-OPEC
FFR	US nominal Federal Fund rate (per cent per annum)	r_t^*	IMF-FRB
NEXR	Nominal official exchange rate (units of LYD per US$)	e_t	WB-CBL-IMF
NDISRATE	Nominal discount interest rate (per cent per annum)	r_t	WB-CBL
NMONS	Nominal money supply (million LYD)	m_t^S	WB-CBL
RNOGDP	Real non-oil GDP (million LYD, constant 2010 prices)	No_t^S	WB-CBL
CPI	Consumer price index (2010 = 100)	p_t	WB-CBL

Sources: WB = World Bank, World Bank Annual Report, 2006, 2016, 2017, 2018.
OPEC = Organization of the Petroleum Exporting Countries, 2016, 2017, 2018, May 2019.
FRB New York = Federal Reserve Bank of New York https://apps.newyorkfed.org
IMF = International Monetary Fund, IMF 2006, 2013, 2016, https://data.imf.org
CBL = Central Bank of Libya, 2010, 2014, 2016, 2018 various issues.

It is expected that the transmission of a world oil price shock to the domestic economy is stronger than that associated with a shock to the US FFR since Libya is an oil-based economy. As explained in Chapter 2, the Libyan monetary and financial sectors are underdeveloped, with non-market determination of the interest rate, little in the way of bond markets, a managed nominal exchange rate and capital controls on the flows of capital into and out of the country. These aspects are important for the transmission of overseas shocks to the domestic economy and the monetary policy instruments most effective in determining RGDP and price level. These aspects will be formalised in the following SVAR specification and identification.

6.3.2 SVAR specification and identification

The model developed here replaces fiscal and external sector variables of the previous model with representative monetary sector variables. It still allows analysis of Dutch disease arising from a world oil price shock, plus potential effects of a foreign interest rate shock on RNOGDP and the CPI. Further, it allows analysis of domestic monetary policy channels relating to the nominal exchange rate, nominal domestic interest and money supply.

In Libya, as in other MENA countries, there are two possible monetary policy instruments: the nominal domestic interest rate and/or nominal money supply (Mahmud, 2009; Elborne, 2007; Adeleke 2014). While some argue the nominal exchange rate and inflation are considered intermediate targets of monetary policy, (Mordi & Adebiyi 2010; Ngalawa & Viegi 2011; Adeniyi & Akongwale 2012), this model specifies RNOGDP and the CPI as final targets, in line with Ruhaet (2010) and the theoretical model presented in Chapter 4.

The X_t vector contains seven variables, divided into two blocks: the exogenous at the top and endogenous variables below. The exogenous WROILP is in the top row. The US FFR is also exogenous to the Libyan economy, but will be affected by WROILP, reflecting US monetary policy responses to world oil price shocks. Therefore, it is placed second.

The NEXR is included with oil price shocks to obtain an accurate picture of the net foreign assets position. This is because exchange rate fluctuations can have a significant impact on the net foreign assets position. Appreciation of a nation's currency against those of other countries will decrease the value of both foreign-currency-denominated assets and liabilities. Domestic prices can adjust money supply in the short term, based on the concept of sticky prices assumed by economic experts such as Dornboush et al. (1996). The NDISRATE is supposed to have an impact on money supply. Thus, the NMONS is assumed to be influenced by the WROILP shock, and the changes in the NDISRATE, NEXR, CPI and NMONS itself.

The nominal exchange rate is placed third because it is managed by the authorities. If it was freely floating, it would be placed further down in the more endogenous region rows of the X_t vector. The domestic interest rate is placed in row four and is theoretically linked to these variables according to the UIRP condition:

$$(r_t - r_t^*) = \left(e_{t+1}^f - e_t\right) + \varepsilon_t \qquad (4.20)$$

A fall in the FFR (r_t^*) means that assets in the US obtain a lower return relative to domestic assets r_t. This will induce capital inflow, which appreciates (decreases) the nominal spot exchange rate $e_t$in period t. The expected future (next period) depreciation increases, since $\left(e_{t+1}^f - e_t\right)$ rises in value maintaining the equality in Equation (4.20). Therefore, repaying the overseas loan in the next period $(t+1)$ will require more domestic currency, offsetting the original benefit of the higher domestic return, so that no further arbitrage profits can be made. This is a theoretical benchmark relationship and deviations will occur since monetary authorities manage the nominal exchange rate and there is imperfect international capital mobility. The intermediate degree of autonomy for the central bank carries through to the nominal domestic interest rate, which is partly endogenously determined according to the demand for money. However, it is also used as a policy instrument through which the Libyan monetary authority sets the interest rate after observing the current values of variables.

The money supply is endogenously determined according to:

$$\dot{M}_t^S = c_{11} + \sum_{i=1}^{K} a_{111}^i \dot{d}c_{t-i} + \sum_{i=1}^{K} a_{112}^i \dot{f}_{t-i} + \sum_{i=1}^{K} a_{113}^i \dot{b}d_{t-i} \qquad 4.19$$

The impact of the stock of foreign asset growth $\dot{f}_t$ is accumulated through the balance of payments under a managed exchange rate. This, coupled with any domestic credit creation $\dot{d}c_t$, increases aggregate demand and the domestic price level. The effect of financing the fiscal budget deficit $\dot{b}d_t$is not included here (if the exchange rate was freely flexible, foreign exchange flows would be automatically sterilised). Thus, one part of money supply is exogenously determined by world oil price and the foreign interest rate. The other part is endogenously determined by the managed nominal exchange rate and the nominal interest rate.

The determination of the endogenously determined RNOGDP and CPI using Equations (4.1) and (4.24) was explained in Chapter 5 and in the previous model of this chapter. It will not be reconsidered here.

These interactions indicate the A_0 matrix in the SVAR will be recursive, where the shock in the world oil price is assumed to influence itself contemporaneously. The FFR is assumed to be affected contemporaneously by the world oil price shock (Kim & Roubini 2000; Nguyen 2014); this is shown by the coefficient (a_{21}) in the A_0 matrix. This variable acts as a proxy for measures of anticipated inflation (Afandi 2005) and the stance of US monetary policy. Obtaining a solution requires some over-identifying zero restrictions. These are that the Federal Reserve rate does not contemporaneously affect the nominal money supply and they both do not affect RNOGDP. The relationships between these variables still exist, but only in terms of lagged dynamic effects.

$$A_0 X_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & 0 & a_{53} & a_{54} & 1 & 0 & 0 \\ a_{61} & 0 & a_{63} & a_{64} & 0 & 1 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{bmatrix} \begin{bmatrix} WROILP_t \\ FRR_t \\ NEXR_t \\ NDISRATE_t \\ NMONS_t \\ RNOGDP_t \\ CPI_t \end{bmatrix}$$

The assumption continues for the residuals, in that shocks have only own contemporaneous effects, with the effects on other variables coming through lag dynamics. There are 73 restrictions imposed and the rank order condition requires 70, so the SVAR is over identified. The model will now be estimated and dynamically simulated.

$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \end{bmatrix}$$

6.3.3 Estimation

Estimation uses 36 annual observations for each of the seven time series variables over 1980–2016, using EViews 8 software. Similar to the previous models, the pre-estimation reveals an optimum lag of 1, according to the AIC, SC and HQ criteria shown in Table 6.5. The other measures indicating lags of 3 or 4 are questionable due to the small sample's lack of degrees of freedom. Table 6.6 shows there is no serial correlation with a lag of 1 at the 5% level of significance. Again, there is no heteroscedasticity according to the tests, with non-normality found the model satisfies the stability condition in Table A6.3.

Table 6.5

VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SC	HQ
0	–895.74	NA	258.00	62.26	62.59	62.36
1	–695.92	289.39	868.14	51.85*	54.49*	52.68*
2	–607.84	85.045	115.51	49.16	54.11	50.71
3	–464.92	68.99*	216.00*	42.68	49.94	44.96
4	4928.63	0.00	NA	–50.91*	–50.33	–48.91*

Notes: * indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table 6.6

Residual Serial Correlation Test

Lag	LM-Statistic	Probability
1	42.94	0.60
2	49.87	0.44
3	36.47	0.91
4	52.30	0.35

Note: Null hypothesis is no serial correlation with VAR lag order

The estimated SVAR are reported in Appendix 6B in Table A6.4. As cautioned previously, the small sample properties are not known and the point estimates and inferences need to be interpreted with great care. As a general observation, the VAR estimates with the variables in levels (similar to Chapters 5 and 6.2) show that the coefficients of the lagged response for each variables are all less than 1, consistent with the stability test and indicating that first differencing of the variables is not required. Both the VAR and SVAR estimates show a positive response of the FFR to the world oil price shock. In this instance, US monetary policy appears to have been tightened in response to positive the world oil price shock. This result is also found in research on other countries (Cushman & Zha 1997; Kim & Roubini 2000, 2008; Afandi 2005; Nguyen 2014). The responses to the world oil price shock are negative for the nominal exchange rate and RNOGDP, and positive for the CPI, consistent with Dutch disease results in Chapters 5 and 6. However, more weight can be placed on the dynamic simulations reported in Section 6.3.4.

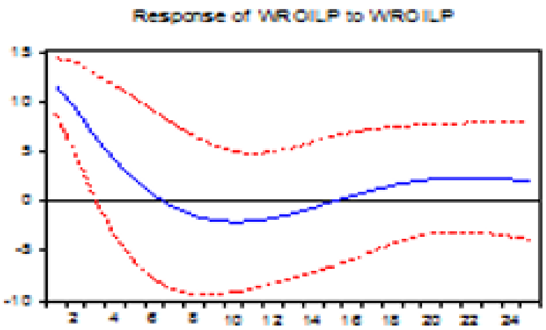
6.3.4 Simulations

This section considers three simulations using IRFs to analyse the effects of the world oil price shock for this monetary model. The first considers Dutch disease effects. The second extends the analysis of the transmission of this external shock to via the US FFR. The third simulation investigates domestic monetary policy responses to the world oil price shock.

6.3.4.1 First simulation: World oil price shock and Dutch disease

Figure 6.5 shows that the effect of the world oil price shock gradually diminishes over the short term (about five periods).

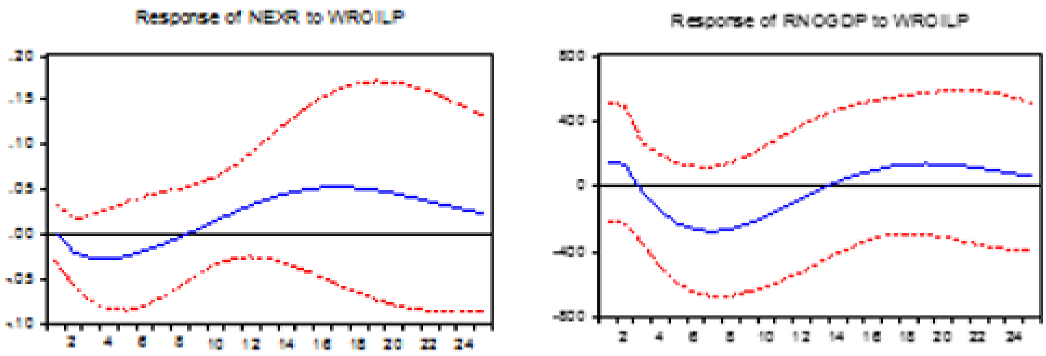
Figure 6.5. Impulse response of the world oil price to its own shock.



The adverse impact of the increased world oil price passes through to appreciate the nominal exchange rate in the short term. The appreciation in Figure 6.6 is relatively smaller in magnitude and period than the appreciations recorded for the models in Chapter 5 and Section 6.2. This is to be expected because these models include measures of the real exchange rate, whereas the nominal exchange rate is managed by the CBL and is, therefore, less flexible.

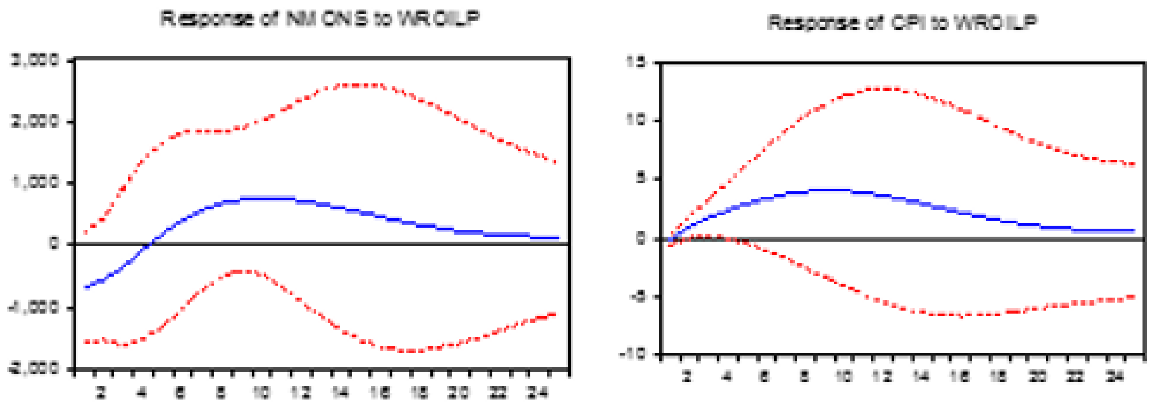
RNOGDP responds with a small lag by deteriorating in the short to medium term. Again, this shows the robustness of the findings of Dutch disease in this model, which includes monetary policy variables. It is also similar to the findings of related studies for other countries that use the oil price shock and a sector of non-oil sectors (manufacturing output response) (Olomola 2006: Mamhud 2009; Riman et al. 2013; Burment 2009, cited in Omolade & Ngalawa 2017).

Figure 6.6. Impulse responses of nominal exchange rate and real non-oil GDP



The IRFs shown in Figure 6.7 indicate that the positive world oil price shock results in an increase in NMONS. This is expected and was discussed previously; oil export revenue in the form of foreign exchange inflow will increase domestic money supply with a managed nominal exchange rate (Olomola 2006, cited in Ben et al. 2016). This endogenous increase accumulates over the short to medium term and returns to its steady state by the end of the period. The CPI appears to respond closely to the increased money supply over these periods.

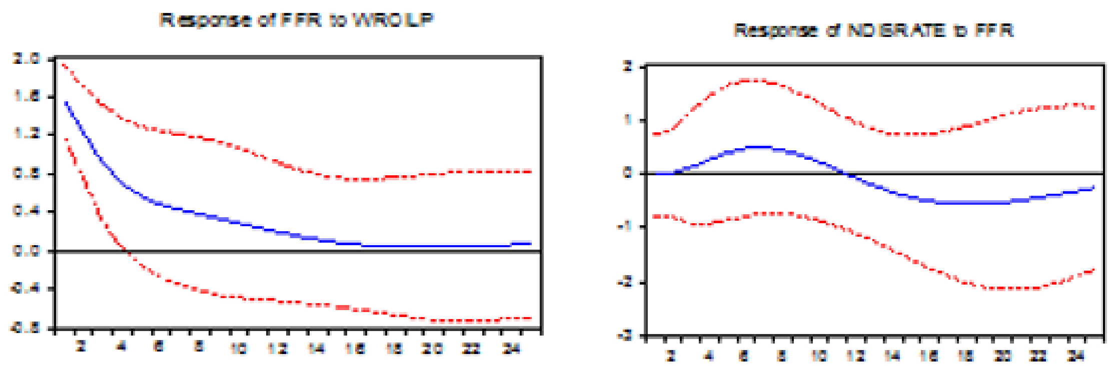
Figure 6.7. *Impulse responses of nominal money supply and CPI*



6.3.4.2 Second simulation: World oil price shock and interest rate response

The simulation here continues the focus on external factors by including the overseas interest rate. Figure 6.8 shows that the world oil price shock has a large and continuing effect on the US FFR. The US interest rate increases and declines slowly, reaching a steady state only at the end of the medium term. This may indicate a contractionary US monetary policy reaction to higher inflation by raising the FFR and possibly to the incorporation of higher inflationary expectations into the rate. The domestic interest rate responds by increasing in the short term, as expected according to the UIRP theory. However, the transmission from overseas is not contemporaneous, with the domestic interest rate increase following the FFR with a lag over the short term. This effect is relatively small and the differences in the movements of these rates (see Figure 6.8) can be attributed to the authorities managing the nominal exchange and interest rates, plus the imperfect international capital movements into and out of Libya. This result is in line with the results for developing countries revealed by Afndi (2005) and Nguyen (2014). These show the influence of domestic monetary policy to foreign interest rate (US FFR).

Figure 6.8. Impulse responses of domestic and overseas interest rates



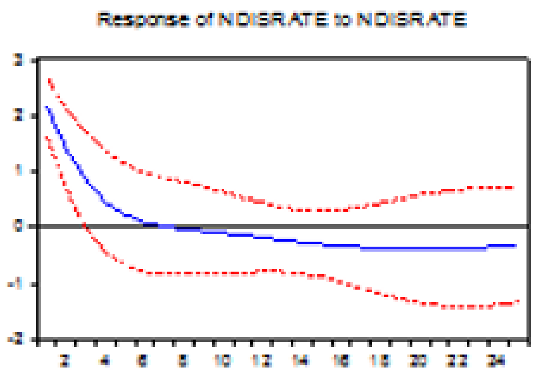
Thus, the effects of the world oil price shock via the FFR are minimal on the domestic nominal interest rate. This is not surprising given the lack of financial development and international monetary transmission mechanisms operating in Libya. It contrasts with the significant simulated direct and indirect Dutch disease effects of the world oil price on the real variables in Chapter 5 and Section 6.2. The final simulations in this section analyses how to mitigate the adverse effects of Dutch disease due to the world oil price shock.

6.3.4.3 Third simulations: World oil price shock and policy responses to reduce domestic interest rate and depreciate nominal exchange rate

Two simulations will be conducted to explore Corden's (2012) second policy suggestion to alleviate Dutch disease effects. This first simulation is of the authorities responding to the world oil price shock by lowering the nominal domestic interest rate to depreciate the nominal exchange rate. The second simulation is a direct intervention by the authorities to depreciate the managed nominal exchange rate. These simulations were enabled by the previous finding that the domestic nominal interest rate and nominal exchange rate are not closely coupled with the US FFR, giving Libyan authorities scope to manipulate these possible instruments.

The difficulty with the first simulation is that it is limited to positive shocks using EViews 8 software. So, Figure 6.9 shows the domestic interest rate response over time to an own increase shock in the first period.

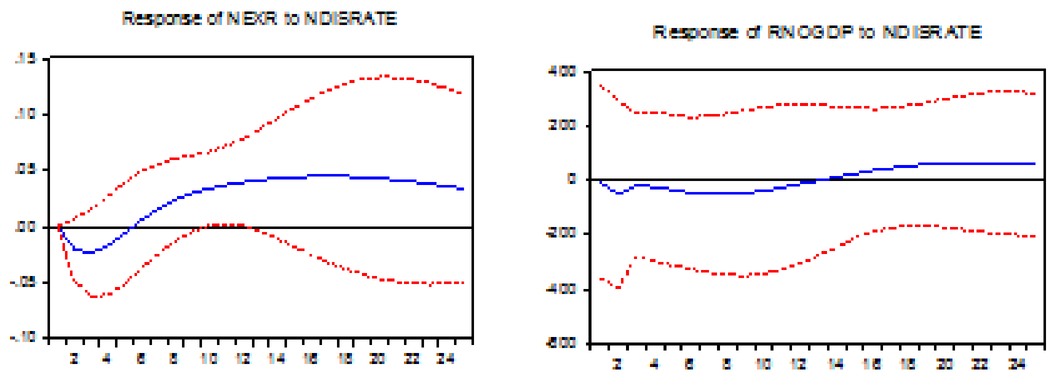
Figure 6.9. Impulse response of domestic interest rate to its own shock



Since this positive shock is for the first period only, it continues to have effects due to lags in the SVAR system. For these following periods, the subsequent decrease in the domestic interest rate can, with a little imagination, characterise an ongoing policy reduction in the interest rate by the authorities, particularly in the short run.

The effects of this subsequent short-term decrease in the domestic interest rate are shown in Figure 6.10. Ignoring the initial exchange rate appreciation due to the positive interest rate shock, the exchange depreciates over the remaining period. Importantly, there is little response of RNOGDP, with only a very mildly positive effect due to the interest rate reduction and depreciation in the long term.

Figure 6.10. *Impulse responses to domestic interest rate increase*



The interest rate transmission mechanism is not effective, so it appears there is little scope for conventional monetary policy manipulation of the domestic nominal interest rate to reverse negative Dutch disease effects.

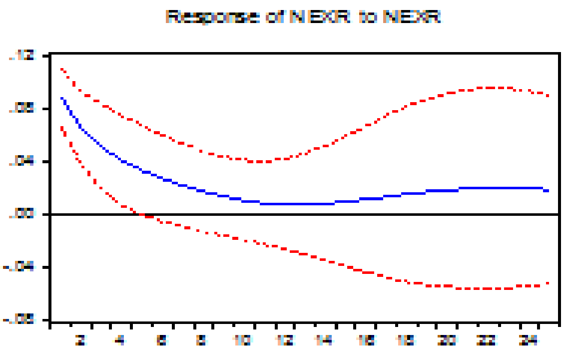
Given this finding, the second simulation explores the effects of a direct depreciation of the nominal exchange rate by the authorities. This depreciation is easily observed in Figure 6.11.A as an increase in the domestic price of foreign exchange. The domestic interest rate responds by falling in the short term. RGDP responds to the depreciation with a rapid increase in the short term. As the depreciation is reduced in the medium term, the RNOGDP falls towards the steady state. This is consistent with the earlier results of this chapter and other studies on oil-exporting developing countries such as those of MENA, Latin America and Africa (Mamhumd 2009; Rima et al. 2013; Haddad & Pancaro 2010). It again confirms that currency depreciation might promote RNOGDP through the improvement output of the real non-oil, especially in traded sectors such as manufacturing (see Olomola 2006; Mordi & Adebiyi 2010; Kutu & Ngalawa 2016).

Figure 6.11.B indicates that the impact of the depreciation is an increase in the CPI. The increase in the price level lags the increase in RNOGDP, so there must be factors other

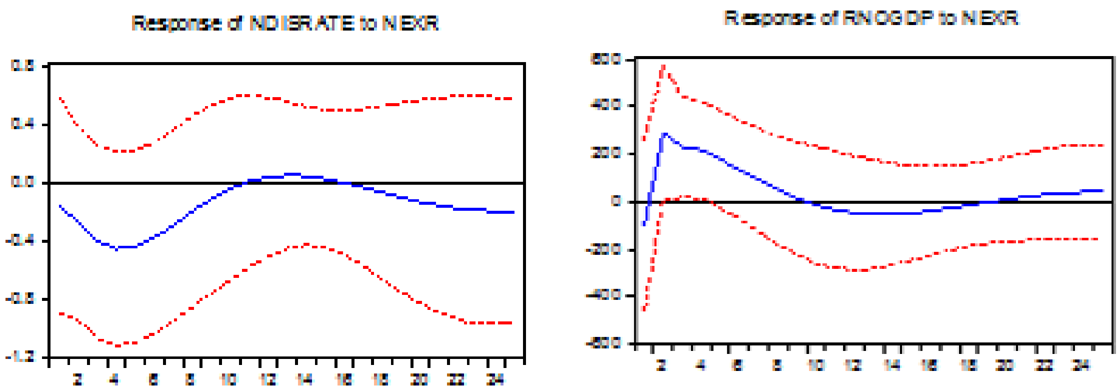
than non-oil demand pressure on the price level. Figure 6.11 also shows that NMONS increases in the medium term. These findings are generally consistent with standard economic theory and studies on developing countries (Tang 2006, cited in Zaidi 2011; Zaidi 2011). This monetary policy of directly depreciating the exchange rate can be effective in overcoming Dutch disease effects on RNOGDP. However, it increases the CPI. This will be considered further in Chapter 7.

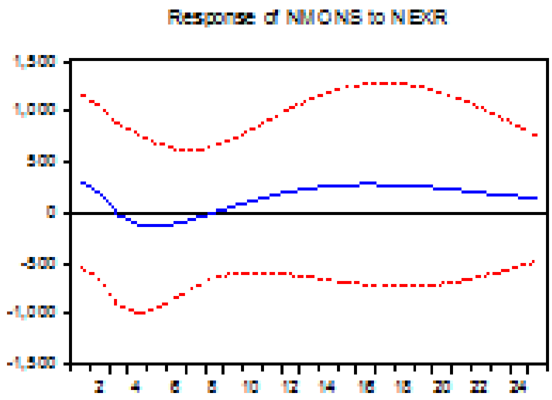
Figure 6.11. Impulse response to depreciated nominal exchange rate.

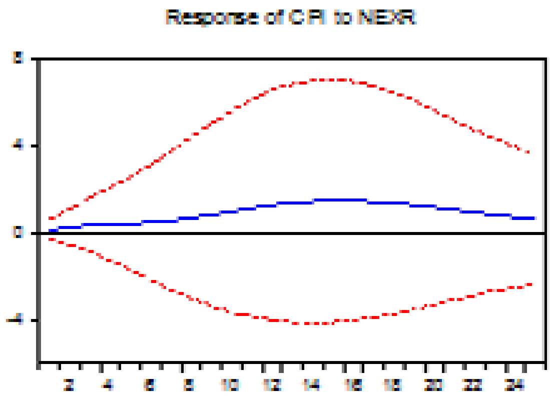
A. Impulse response of nominal exchange rate to its own shock



B. Impulse response of macroeconomic factors to nominal exchange rate shock







6.4 Conclusion

This chapter examined the impacts of oil price shock on the domestic Libyan economy and the possible macro-economic fiscal and monetary policy responses. Two related SVAR models were specified, based on the theoretical model in Chapter 4, estimated and dynamically simulated using IRFs. A crucial factor in both models is the management of the exchange rate by Libyan authorities.

The first model in Section 6.2 comprises six variables, including the RFSB, a real non-oil trade balance and a REXMP. The first of three simulations explored the dynamic existence of Dutch disease. It was found that the shock to the world oil price appreciates the REXMP in the short term (first five periods). The RNOTRD responds by moving into deficit over this same period. The initial stimulus to RNOGDP, caused by the world oil price increase, diminishes over this same period and becomes negative in the medium run. This is evidence of Dutch disease in Libya and supports the robustness of the findings in Chapter 5.

The second simulation investigated the relationship between responses in the RFSB and real non-oil trade balance to the oil price shock. The RFSB moves into surplus due to the oil revenue effect from the world oil price shock. However, it remains positive for only a few periods, then declines quickly into deficit in the short term, remaining in deficit in the medium term. The impact of a positive world oil price shock also leads to a decline in the RNOTRD in the short and medium term. This supports the twin deficits hypothesis—the concurrence of deficits in the both the real fiscal budget and real non-oil trade balances. However, there is also an increase in the domestic price level in the long term. This is unsurprising given the world oil price shock and increasing fiscal deficit funded by money creation in the increased foreign exchange oil revenue.

The third simulation examined the response of the REXMP to moving the real fiscal budget into surplus. This tested the first suggestion of Corden (2012) to alleviate Dutch disease impacts. The IRFs show that a real fiscal budget surplus depreciates the nominal exchange rate, which quickly moves the RNOTRD into surplus. RNOGDP and the trade balance move quickly to a steady state. These results demonstrate that, in response to a positive world oil price shock, moving the fiscal budget into surplus pulls the non-oil trade deficit into surplus, which overcomes Dutch disease effects and the twin deficits problem.

The second model in Section 6.3 focuses on monetary policy and replaces the fiscal and trade variables with nominal interest rates and money supply. The managed exchange rate assumption remains, but the real rate is replaced with the nominal exchange rate. The seven-variable SVAR model was simulated three times.

The first simulation showed that the world oil price shock appreciates the nominal exchange rate and worsens RNOGDP, again confirming the presence of Dutch disease. However, the nominal appreciation over the short term is relatively smaller than in the fiscal model in Part A. This reflects the inclusion of the nominal exchange rate, which is managed by the CBL and is therefore less flexible than the REXMP included in the fiscal model. Despite this, the reduction in RNOGDP extends from the short into the medium term. The nominal domestic money supply also increases over the short to medium term due to the foreign exchange inflow from additional oil revenue with a managed nominal exchange rate. The CPI appears to respond closely to the endogenous increase in money supply over the sample period.

The second simulation continued to examine external factors in terms of the world oil price shock on the US FFR and the transmission to the nominal domestic interest rate. The FFR responds positively to the world oil price shock in the short to medium term, presumably because of contractionary monetary policy in the US. However, the lagged response of the domestic nominal interest rate is confined to the short term and relatively small. Therefore, the transmission of the world oil price shock to the Libyan economy via the US and domestic interest rates is not close or effective. UIRP does not hold due to restrictions on international capital movements and the CBL's management of the nominal exchange rate.

The breakdown in UIRP gives the CBL scope to manipulate the domestic nominal and nominal exchange rates separately. The final simulations analysed the effectiveness of these two possible monetary policy instruments to offset the effects of the world oil price shock. Simulating the lowering of the domestic interest in response to the oil price shock depreciates the exchange rate, but unfortunately it has very little effect on RNOGDP over the sample period. This lack of an effective interest rate channel means that this is not a useful instrument to offset Dutch disease effects.

However, the simulation of a direct depreciation conducted by the CBL is more effective. RNOGDP responds by rapidly increasing in the short term and diminishing in the medium term as the depreciation moderates. This monetary policy instrument has the potential to offset Dutch disease arising from a world oil price shock, but it also leads to endogenous increase in domestic money supply over the medium term, and in the CPI in the long term.

In summary, Corden's (2012) first recommendation to move the real fiscal budget into surplus overcomes Dutch disease effects in Libya caused by a world oil price shock. The fiscal surplus depreciates the REXMP, improves RNOTRD and stimulates RNOGDP. This important finding does not indicate how best to create the fiscal budget surplus. Corden's (2012) second recommendation to reduce the domestic interest rate in response to the world oil price shock was not successful using the Libyan data, although responding by directly depreciating the nominal exchange rate does stimulate RNOGDP. While this is also important in identifying appropriate monetary policy instruments, there is the remaining issue that depreciation does increase domestic money supply and the price level. Central to the fiscal and monetary policies analyses here is the exchange rate being managed by the Libyan authorities. These remaining important policy questions will be considered in Chapter 7.

Chapter 7: Macro-Economic Policy Analysis Under a Flexible Exchange Rate

7.1 Introduction

The application of appropriate macro-economic strategies has helped reduce the adverse impacts of Dutch disease in developed countries experiencing resource price booms. Oil-exporting countries like Norway (Balabay 2011) and Australia (Mohammadzadeh 2015) have been able to reduce the adverse consequences of positive resource price shocks with appropriate macro-economic policies. Crucial to the success of these polices was their operation under flexible exchange rate regimes.

This chapter conducts a number of simulations relating to a world oil price shock and investigates potential policy responses based on the theoretical macro-economic model developed in Chapter 4. According to the simulations of the empirical models conducted in Chapters 5 and 6, current macro-economic policies involving managed exchange rates indicate the presence of Dutch disease. Its existence is demonstrated through appreciation of the nominal and real exchange rates, a lower non-oil trade balance, reduced non-oil GDP and a higher domestic price level.

The objective of this section is to analyse, with a flexible exchange rate, possible fiscal and monetary policies that mitigate Dutch disease in Libya. Several alternative strategies are possible; this chapter comprises three scenarios. The first focuses on fiscal policy in terms of comparing the very different effects of public consumption with public investment spending, under a flexible real exchange rate. Section 7.3 analyses fiscal and monetary policies under a flexible nominal exchange rate. Section 7.4 attempts to overcome some deficiencies, particularly relating to the price level, by focusing on monetary policy in terms of applying a Taylor rule with a flexible nominal exchange rate. The final summary section in this chapter compares the effects of these strategies to provide important insights for policymakers on the adjustment processes and consequences of alternative policy scenarios. These lessons mitigate the adverse impacts of Dutch disease on small, open oil-exporting developing economies such as Libya.

7.2 Fiscal Policy Responses to a World Oil Price Shock under a Flexible Real Exchange Rate

The model to be simulated for fiscal policy strategy is based on the SVAR model in Chapter 6 (Section 6.2.2); the real flexible exchange rate and non-oil trade balance are included with the world oil price shock. However, this model is extended to include real government consumption and investment expenditures, along with real private sector expenditures (consumption and investment). Taxation has not been included since, as explained before, it represents a small contribution to public receipts. The revenues from oil exports are included in terms of fiscal spending and in changes in money supply and domestic prices. The effects of the world oil price shock in the short, medium and long term are categorised into two scenarios.

Case 7.2A outlines a scenario in which the government prioritises real consumption expenditure over real investment expenditure. This means the government spends a large amount of oil revenue on current (consumption) expenditures and only a minimum amount, for capital (investment) expenditures (see Chapter 2). Case 7.2B investigates the alternative scenario, in which the country focuses on development infrastructure and prioritises investment spending.

The analysis is conducted using the variables shown in Table 7.1. Section 7.2.1 explains the SVAR model specifications and identification.

Table 7.1

Description and Sources of Data for Chapter 7

Variable	Description	Model Symbol	Source
WROILP	World average oil prices (USD per barrel)	po_t	WP-
TRGS	Total real government expenditure (million constant LYD 2010 prices)	g_t	WP- CBL-IMF
GOVCON	Real government consumption expenditure (million constant LYD 2010 prices)	con_t^g	WB- CBL
GOVINV	Real government investment expenditure, (million constant LYD 2010 prices)	i_{t-i}^g	WB- CBL
RPRIVCON	Real household private final consumption expenditure (million constant LYD 2010 prices)	con_{t-1}^p	WB
RPRVINV	Real private gross fixed capital formation (million constant LYD 2010 prices)	i_{t-i}^p	WB-CBL-AFDB
NMONS	Nominal money supply (million LYD)	m_t^S	WP- CBL
RMONS	Real money supply (nominal money supply adjusted by CPI, 2010 = 100)	$m_t^S - p_t$	WB-CBL
NDISRATE	The nominal interest rate (% per annum)	r_t	WP- CBL
NEXR	Nominal official exchange rate Units of domestic currency per a unit of US currency (LYD per US$)	e_t	WP-CBL-IMF
REXMP	Real effective exchange rate Weighted average of the domestic price of imported non-oil goods using an import index ($e_t + p_t^n$) deflated by the price level p_t	$er = (e_t + p_t^n - p_t)$	WB-IMF
RNOGDP	Real non-oil GDP (million constant LYD 2010 prices)	No_t^s	WB-CBL
RNOTRD	Real non-oil trade balance of goods and services (million LYD, constant LYD 2010	NTP_{t-i}	CBL-IMF-WB,
CPI	Consumer price index (2010 = 100)	p_t	WB-CBL

Sources: WB = World Bank Annual Report, 2006, 2016, 2017, 2018.
OPEC = Organization of the Petroleum Exporting Countries 2016, 2017, 2018, 2019.
AFDB = African Development Bank 2008, 2012, 2017.
IMF = International Monetary Fund, 2006, 2013, 2016.
CBL = Central Bank of Libya, 2010, 2014, 2016.

7.2.1 SVAR specification and identification.

The model of this section is based on the SVAR model of Chapter 6 and includes theoretical aspects developed in Section 4.2.5 for public consumption, and Section 4.2.6 for public investment. The model comprises a system of nine equations to show how the effects of a world oil price shock are transmitted to the domestic economy, in particular to the flexible real exchange rate, RNOGDP and CPI. The analysis importantly indicates the effectiveness of fiscal policy channels.

$$A_0X_t=\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & 0 & 1 & 0 & 0 & 0 & 0 \\ a_{61} & 0 & 0 & a_{64} & a_{65} & 1 & 0 & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 & 0 & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 & 0 \\ a_{91} & a_{92} & a_{93} & a_{94} & a_{95} & a_{96} & a_{97} & a_{98} & 1 \end{bmatrix}\begin{bmatrix} \text{WROILP} \\ \text{GOVCON \& GOVINV} \\ RMONS \\ RPRIVCON \\ RPRVINV \\ RNOTRD \\ RNOGDP \\ CPI \\ REXMP \end{bmatrix}$$

Similar to Chapters 5 and 6, the WROILP is considered fully exogenous and assumed to contemporaneously influence all variables in the model. Therefore, it is placed in the top row of the A_0 matrix and the X_t vector. Since government spending is also determined politically and socially according to institutional characteristics and requirements, it is placed second. It is only contemporaneously affected by the world oil price, which transmits to RNOGDP and domestic prices through the fiscal policy transmission mechanism in oil-exporting developing countries (Jemenez et al. 2005). That is, government spending approximately follows the world oil prices shocks. This spending comprises government consumption con_{t-i}^{g} and investment spending i_{t-i}^{g} , including investment in human capital investment i_{t-i}^{gh} and investment in infrastructure i_{t-i}^{gf}. This effect is shown in the theoretical model through the following equations (see Chapter 4):

$$g_t = c_3 + \sum_{i=1}^{K} a_{32}^{i}\, con_{t-i}^{g} + \sum_{i=1}^{K} a_{33}^{i}\, i_{t-i}^{gh} + \sum_{i=1}^{K} a_{34}^{i}\, i_{t-i}^{gf} \qquad 4.5$$

k_{t-i}^{gh*}=ɳ$_1(o_t^x + po_t + er_t)$ 4.7b

k_{t-i}^{gf*}=ɳ$_2(o_t^x + po_t + er_t)$ 4.8b

$con_{t-i}^{g} = (1 - ɳ_1 - ɳ_2)(o_t^x + po_t + er_t)$ 4.9

Each of the government consumption and investment components (GOVCON and GOVINV) are included separately in the second row of the A_0 matrix. This is the approach taken by Mohammadzadeh (2015), Ali (2011) and Alkahtani (2013). The reason for separating these effects is to focus on each IRF: first, a shock to GOVCON independent of GOVINV and second, a shock to GOVINV independent of GOVCON. The combined effects will be considered in the next section.

The study assumes that higher oil revenue associated with higher world oil prices results in an expansion in the money base (in domestic currency), which will lead to increases in the nominal and real money supply $(m_t^S - p_{t)}$. Thus, RMONS is placed in the third row in the matrix. In addition, foreign receipts from government-owned oil sales (revenue from oil exports) $(o_t^x + po_t + er_t)$ and real money supply are considered the main factors to determine the RFSB equation for Libya (see Chapter 4).

$$bd_t = c_6 + \sum_{i=1}^{K} a_{61}^{i}\left(m_{t-i}^{S} - p_{t-i)}\right) + \sum_{i=1}^{K} a_{62}^{i}(o_{t-i}^{x} + po_{t-i} + er_{t-i}) \qquad 4.12$$

Higher world oil prices reflecting higher demand for oil exports, plus increases in government spending and increases in money supply, will all encourage multiplier effects on real private consumption (RPRIVCON) and investment (RPRIVINV) spending (Hailu & Debele 2015). These private expenditures are placed in rows four and five of the A_0 matrix. RPRIVCON is placed in the row above RPRIVINV, reflecting its relative importance and inertia in private spending. However, the zero restriction reflects that RPRIVCON does not necessarily contemporaneously determine RPRIVINV. These private expenditures will in turn affect RNOTRD, which is placed in row six. The zero restrictions mean that government spending and real money supply are assumed to not contemporaneously affect real non-oil trade.

RNOGDP is placed seventh because it is determined by all these expenditures, in particular private, government and overseas demand expenditures aggregating to the demand for non-oil output No_t^d as shown in Equation (4.1):

$$No_t^d = c_1 + \sum_{i=1}^{K} a_{11}^{i}\, con_{t-i}^{p} + \sum_{i=1}^{K} a_{12}^{i}\, i_{t-i}^{p} + \sum_{i=1}^{K} a_{13}^{i}\, g_{t-i} + \sum_{i=1}^{K} a_{15}^{i}\, (NTP_{t-i}) \qquad (4.1)$$

Domestic price (CPI) is influenced by all these variables, according to Fargani (2013) and CBL (2016). The REXMP is assumed to be the most endogenous variable, affected by all factors in the model, since it is a flexible real exchange rate. Therefore, it is located in the last row of the A_0 matrix.

The B matrix is specified to be diagonal so that individual shocks are restricted to contemporaneously only have own affects. However, it is not an identity matrix, allowing differences across the own effects.

$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & b_{88} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & b_{99} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \\ \varepsilon_{8t} \\ \varepsilon_{9t} \end{bmatrix}$$

The A_0 matrix and B vector in the SVAR model specified above has 120 zero and unity restrictions imposed. This is more than the required $2n^2 - n(n+1)/2 = 117$ restrictions for $n = 9$ variables, meaning the system is over identified. The VAR and SVAR will now be estimated and simulated for a shock to the world oil price.

7.2.2 SVAR fiscal policy simulations

Two scenarios will be considered: Case A will include real government consumption expenditure, while Case B will focus on real government investment expenditure. This will allow comparison of the dynamic responses.

7.2.2.1 Real government consumption expenditure (Case A)

The SVAR is first estimated with the variable RGOVCON placed in the second row of the A_0 matrix and the X_t vector.

The tests suggest a lag of 1 or 2, based on the lag order selection criteria AIC and SC. However, the study ran VAR and SVAR models with lag 1 to be consistent with other models in this thesis, and to reduce the degrees of freedom constraint, allowing the matrix to run. There is no serial correlation in the residuals with a lag of 1, and no heteroskedasticity, both at the 5% level of significance. While the issues of normality remain, the model satisfies the stability condition. These tests are reported in Appendix 7, in Tables A7.1.1 to A7.1.5.

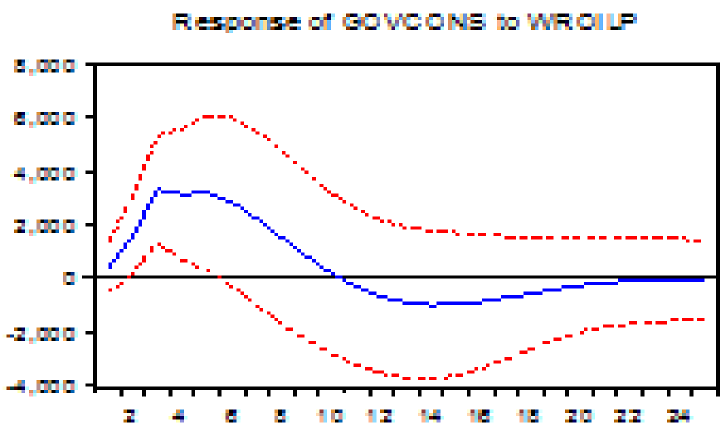
The estimates of the SVAR are also reported in the Appendix 7 in Tables A7.2.1 and A7.2.2. These results are reported in the appendix to focus this chapter on the dynamic effects of the world oil price shock and the fiscal policy implications to alleviate its adverse Dutch disease impacts on the Libyan economy. Accordingly, emphasis is given to explaining the dynamic analysis using IRFs, rather than by examining point and interval parameter estimates. As discussed previously, there is continuing debate about the properties of the estimated parameters, especially for small samples. In contrast, IRFs have been used extensively to trace the responses of domestic variables to external shocks and to examine the effectiveness of policies (Koop et al. 1996; Pesaran & Shin 1998, cited in Abdurohman 2010; Liu & Jansen 2103).

The shock is in the form of a one-off standard deviation increase in the world oil price in the first period, which as shown in previous chapters slowly declines over time due the VAR lags. Therefore, the IRFs indicate the short, medium and long term dynamic effects of the fiscal policy channel that prioritises current (consumption) expenditure.

This channel focuses on the effect of the oil price increase on real government consumption spending, which in turn affects real private consumption and investment spending, leading to final effects on real non-oil output and price. Effects on the other variables are not reported here, but can be observed in the SVAR estimations in Tables A7.2.1 and A7.2.2. This induced increase in government spending is why the SVAR has separately included real government consumption expenditure here, and later investment expenditure. It is so the induced increase is forced into fiscal consumption spending and later into fiscal investment spending. This will aid comparison of the differing expenditure effects.

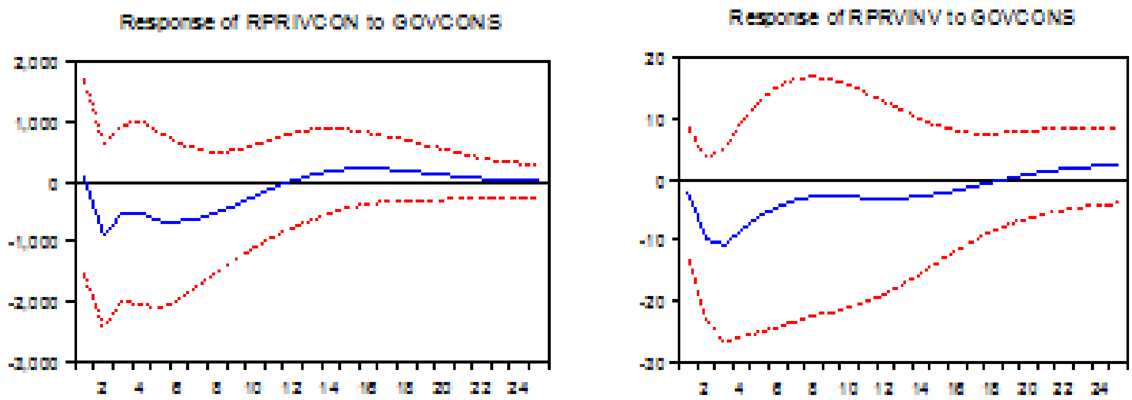
The simulation depicted in Figure 7.2.1 indicates that the effect of world oil price increase on real government consumption expenditure is strongly positive during the short-run periods of around two to six, diminishing over time to zero only in the medium term, after 10 periods. This is consistent with the discussion above—increased official oil revenues held by the government translate to increased fiscal spending (in this case, current spending).

Figure 7.2.1. Impulse response of real government consumption to a world oil price shock



Rather than trace the effects of world oil price shock to the other variables of interest, this analysis focuses on the fiscal transmission mechanism in terms of how the induced increased real government consumption spending affects the real private sector spending and therefore, real non-oil output and the price level. Figure 7.2.2 shows that higher real government consumption spending has adverse impacts on real private spending. Real private consumption spending is negative in the short and medium term. Real private investment spending is also negatively affected; this negative effect was strong in the short term and declined after that, although the negativity extended into the long term. There is certainly evidence of the 'crowding out' of private spending in the short term, and potentially in the long term due to the prevailing negative effect on private investment.

Figure 7.2.2. Impulse response of real private sector expenditure to an increase in real government consumption

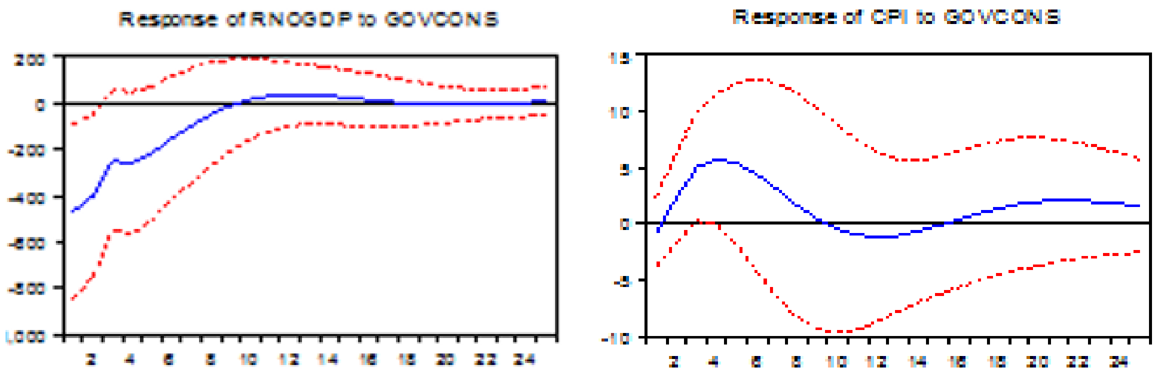


Not surprisingly, these reductions in private spending (and evidence of Dutch disease discovered in Chapters 5 and 6) drag down RNOGDP, as shown in Figure 7.2.3. Real non-oil GDP is negatively affected in the short run, and slowly increases but remains negative in the medium term, reverting to the baseline value in the long term. The domestic price (CPI) increases in the short term, along with the increase in the world price of oil. This was addressed in previous chapters, with higher oil revenue generating demand for both tradeable and non-tradeable commodities. This subsequently increases the domestic price, since there is little response from the supply side in terms of RNOGDP. Stagflation results, with evidence of the transmission from the external shock to increasing government consumption expenditure, which 'crowds out' private spending.

As explained in Chapter 2, other studies show non-oil output and non-oil exports have suffered in Libya and cannot improve due to the adverse impacts of government consumption expenditure at the expense of public and private investment (Fargani 2013;

Edwik 2007; African Development Bank 2012, 2017). Under the minimum investment expenditure scenario, there is not enough upward improvement in private capital formation and public provision of infrastructure and human capital (health and education) (Ali 2011; Ali & Harvie 2015b).

Figure 7.2.3. Impulse response of real non-oil GDP and CPI to an increase in real government consumption



Overall, it can be argued that a policy of minimal government expenditure on investment and higher government expenditure for consumption has exacerbated Libya's economic dilemmas. The unyielding focus on the oil sector and oil revenues has created a negative spiral for the Libyan non-oil sector (Dutch disease). Therefore, Section 7.2.2.2 investigates and compares the possible effects relating to public investment expenditure with a world oil price shock.

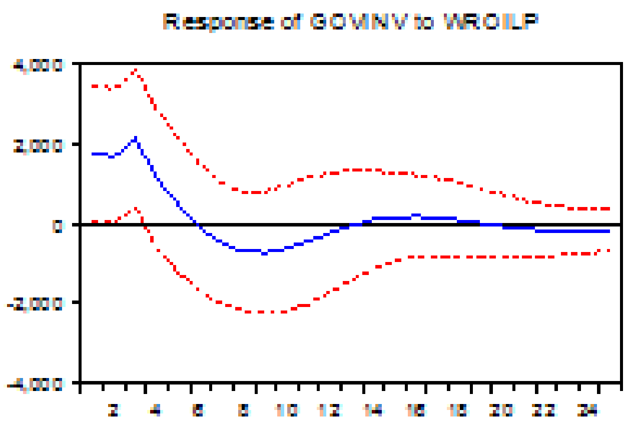
7.2.2.2 Real government investment expenditure (Case B)

The motivation to study this is based on the arguments that it is crucial for the government of an oil-exporting economy to spend oil revenue on the productive supply side (physical and human capital assets) to achieve increases in output (Hartwick 1977; Hannesson, 2001; Ali & Harvie 2017). A focus on development investment expenditure in the non-oil sector is required to develop the productive assets necessary for promoting non-oil output and stable prices. Investment in public infrastructure—including roads, ports, railways, power networks, water systems and technology—and human capital—

schools, universities and hospitals—is of paramount importance (Clark et al. 2013, cited in Mohammadzadeh 2015). Investment in these areas would also help the economy reduce the adverse effects of Dutch disease (Mohammadzadeh 2015).

The SVAR includes GOVINV in the second row of the A_0 matrix and the X_t vector. The VAR and SVAR results and tests are reported in the Appendix Sections A7.1 and A7.2. Figure 7.2.4 shows that the positive oil price shock increases real government investment for the first three periods; it then declines to zero over the short term (period 6). This induced increase is slightly less and shorter lived than that for real government consumption (see Figure 7.2.1). Nonetheless, it is still positive and reflects the preference of the Libyan government for public consumption spending over public investment spending in the historical data used in estimation of the SVAR model.

Figure 7.2.4. Impulse response of real government investment to a world oil price shock



The positive impacts of increased real government investment spending on real private consumption and investment spending are shown in Figure 7.2.5. This is a striking result, providing evidence using accepted econometric modelling techniques that public investment is associated with 'crowding in' of private spending. Moreover, it is opposite to the effects of government consumption spending 'crowding out' private spending in Figure 7.2.2. The time frames are similar. The improvement to real private consumption spending is confined to the short term, while the short-term improvement in real private investment spending extends to the long term. This implies potentially greater and longer-term benefits of public investment.

Higher real public investment may raise the marginal productivity of real private capital and thereby 'crowd in' real private investment (Aschauer 1989; Harvie & Kearney 1996). Hence, investment in these sectors has been considered key in promoting private sector production, non-oil output supply, and hence, sustainable economic development (Ali 2011). Such positives can offset the loss of international competitiveness arising from the strong appreciation of the exchange rate due to Dutch disease (Morrison & Schwartz 1996)40. In so doing, real private investment and real private consumption show a positive reaction to higher investment expenditure.

Figure 7.2.5. Impulse response of real private sector expenditure to an increase in real government investment

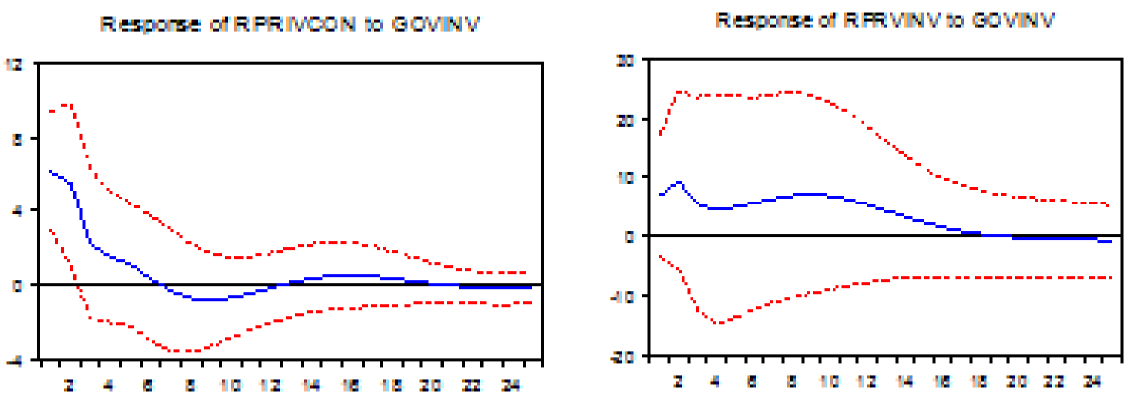
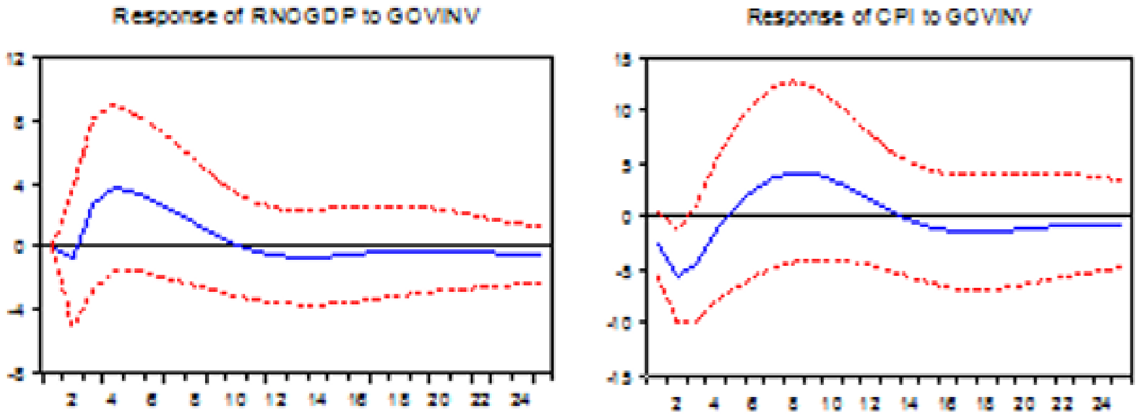


Figure 7.2.6 shows that the increase in government investment expenditure, induced by the higher oil revenue from the positive world oil price shock, has a positive effect on RNOGDP. The fiscal transmission mechanism is clear here in the short to medium term, in periods 2–10. It is the opposite effect, with differences, to the negative effect for real government consumption expenditure shown in Figure 7.2.3. Similarly, the effect on price is the opposite, with the CPI initially falling in the first four periods. It then increases and becomes positive over the next 10 periods.

[40] Morrison and Schwartz (1996) suggested production cost reduction as an outcome through a productivity-enhancing channel for the private sector, offsetting the loss of international competitiveness arising from the strong appreciation of the exchange rate.

Figure 7.2.6. Impulse response of real non-oil GDP and CPI to an increase in real government investment



These results are supported by Aschauer (1989), Baxter and King (1993), Harvie and Kearney (1996) and Dreger and Reimers (2016), who found a complementary relationship between public government expenditure and private sector productivity, which can further influence RNOGDP and CPI. Thus, it can be argued that increased investment expenditure has a positive impact on the productivity of both public and private sectors, which enhances real non-oil output and RNOGDP (Blanchard & Perotti, 2002; De Castro & Hernandez de Cos 2008).

However, two issues remain. First, studies (Alkahtani 2013; Mohammadzadeh 2015; Ali & Harvie 2017) have argued that there is lag in the effect of government spending on productive assets. An increase in the oil price, and consequently oil revenue, may encourage the government to invest those funds in new infrastructure or human capital projects that improve real output of the non-oil sector. It takes time for these projects to become effective and for the supply side to respond. This lag is not apparent in the impulse response dynamics. The second issue—the negative effect on the price—is only short-lived, with the CPI increasing and becoming positive as the economy moves from the short to medium term.

Overall, the results in this section demonstrate that increased oil revenue from the world oil price shock, if used to increase real government investment spending, increases real private sector expenditure in terms of consumption in the short term and investment in the short to longer term. RNOGDP subsequently increases over the short to medium term. In contrast, if the real government spending is directed towards consumption, private expenditure decreases in terms of consumption in the short term and investment in the long term.

These are remarkable results. They also provide direction for policymakers in Libya on how best to operationalise Corden's 2012 proposal to move the fiscal budget in the surplus direction to reduce Dutch disease effects. The evidence in this section directs authorities to reduce real public consumption expenditure rather than real public investment expenditure. Indeed, the mix between these expenditures can be further calibrated to increase public investment.

Despite this, problems associated with the lagged effects of government investment and the increase in the CPI remain. Therefore, it is imperative to incorporate monetary policy in the analysis. Section 7.3 will examine how to coordinate fiscal and monetary policy to achieve better outcomes in terms of RNOGDP and the CPI for Libya—goals that have been recommended by the IMF team that visited Libya in 2003 (IMF Country Report 2006, 2008).

7.3 Fiscal and Monetary Policy Responses to a World Oil Price Shock Under a Flexible Nominal Exchange Rate

The results in the previous section demonstrate that a higher domestic price results in both scenarios of the fiscal policy response to a world oil price shock. A higher domestic price can be not only considered to be an isolated problem, it can also have significant impacts on real private investment and output, and RNOGDP. The aim of this section is to incorporate monetary aspects into the model, principally to better manage the price level. This involves domestic nominal variables like the nominal interest rate, NMONS and flexible nominal exchange rate. The inclusion of these variables allows the analysis of monetary policy and Dutch disease in nominal terms. In doing so, it further tests the robustness of the findings of Dutch disease in the previous chapters.

Fiscal spending is also included because the possible monetary effects, if ignored, will produce undesirable results, especially for oil-exporting developing countries (Nordhaus 1994; Mohammad et al. 2009). Fiscal authorities are generally reluctant to reduce government spending, which may lead to large budget deficits, higher interest rates, lower domestic spending, lower RNOGDP and higher domestic prices. Harmonised fiscal and monetary policies were recommended by the IMF team that visited Libya in 2003 (IMF Country Report 2006, 2008), Khan and Mezran (2013), Alimohamed (2014) and the African Development Bank (2017) as a vital step in addressing low real GDP growth and high domestic prices in Libya. In this regard, it is imperative to determine appropriate macro-economic policies that include fiscal and monetary channels and policy instruments in one model. These policies can also be directed to alleviate the adverse impact of Dutch disease in oil-exporting countries such as Libya.

The analysis can be open-ended and still not cover all aspects that relate to a combination of fiscal and monetary policy channels. This analysis is exploratory and simplified to capture the major effects. The selected key variables used in the SVAR model are shown and explained in Table 7.1. Total real government spending estimates are gross government expenditure values in terms of base-year price (constant LYD prices) (World Bank 2016, 2017). The domestic interest rate is deterimented by the discount interest rate, which is the interest rate between the CBL and Libyan commercial banks (Central Bank of Libya 2010).

Section 7.3.1 will explain the SVAR specifications and identifications of the model. The shock to the world oil price remains and the analysis focuses on monetary responses operating under a flexible nominal exchange rate.

7.3.1 SVAR specification and identification.

The SVAR model of this section is based on the IMF's 2003 recommendation for Libya to improve RNOGDP and domestic price outcomes simultaneously through coordinated fiscal and monetary policies. The focus is the monetary channels and policy, as explained in Section 4.3.1.2. The model is an extension of the SVAR asset market model specified in Section 6.3.2, importantly with a flexible nominal exchange rate replacing the managed nominal exchange rate. This continues the floating exchange rate analysis of the previous section (although in nominal rather than real terms) and contrasts with the managed exchange rates of Chapters 5 and 6.

The model comprises seven variables, which are shown in the following A_0 matrix and X_t vector.

$$A_0X_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 \\ a_{41} & 0 & a_{43} & 1 & 0 & 0 & 0 \\ a_{51} & 0 & a_{53} & 0 & 1 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & 0 & 1 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & 1 \end{bmatrix} \begin{bmatrix} WROILP \\ TRGS \\ RNOGDP \\ CPI \\ NMONS \\ NDISRATE \\ NEXR \end{bmatrix}$$

Fiscal policy is simply represented by total real government expenditure (TRGS) to keep the model as simple as possible and to focus on monetary policy (considering the findings from the previous section on how best to direct this expenditure). Fiscal policy is important in terms of having long-term impacts on RNOGDP and being the main channel through which to achieve economic development (Nelson & Plosser 1982; Samba 2013; Mahmud 2009). As mentioned previously, fiscal spending is determined by structural and institutional factors; therefore, it is more exogenous in determination, funded almost entirely by official oil revenues (see Chapter 2) obtained from the exogenous WROILP shock. Thus, it is in the second row of the A_0 matrix. The world oil price and real government spending affect RNOGDP, which is included in the third row of the A_0 matrix. The world oil price and real non-oil output are expected to affect the level of prices (CPI), which is in row four.

The three remaining variables are placed in the rows below the domestic real variables, reflecting their inherent endogeneity due to them being nominal monetary measures. The NMONS is placed below the CPI since it assumed to be endogenously affected by monetary policy. This is shown in Equation (4.19) in Chapter 4. The change in the NMONS depends on the growth rate of domestic credit expansion $\dot{dc}_{t-I}$ that is assumed to be determined according to current central bank policy. Under a flexible nominal exchange rate, the central bank has more independence and control over the domestic NMONs, such that foreign capital inflows are automatically sterilised with $\dot{f}$ = 0 in Equation (4.19).

$$\dot{M}_{t-i}^{S} = c_{11} + \sum_{i=1}^{K} a_{111}^{i}\dot{d}c_{t-i} + \sum_{i=1}^{K} a_{112}^{i}\dot{f}_{t-i} + \sum_{i=1}^{K} a_{113}^{i}\dot{b}d_{t-i} \qquad 4.19$$

The zero restriction in the A_0 matrix, indicating no contemporaneous fiscal spending effects on domestic money supply, assumes the flexible exchange rate sterilises the foreign exchange oil revenue inflows used to fund domestic fiscal expenditure. These well-known effects will come through with lags, as shown starting with $i = 1$ rather than the contemporaneous effects with $i = 0$ in the lags for $\dot{f}_{t-i}$ and for $\dot{bd}_{t-\iota}$ in Equation (4.19).

The nominal interest rate (NDISRATE) is affected by all variables, including fiscal spending, and placed in the second-last row of the A_0 matrix. However, the zero restriction assumes it to be contemporaneously independent of the nominal money supply, since they are determined according to the monetary policy stance with lagged system interactions. This is shown with the lag operator starting at $i = 1$ for the $a_{101}^{i}r_{t-i}$ term in Equation (4.18):

$$M_{t}^{d} = c_{10} - \sum_{i=1}^{K} a_{101}^{i}\pi_{t-i} - \sum_{i=1}^{K} a_{102}^{i}r_{t-i} + \sum_{i=1}^{K} a_{103}^{i}No_{t-i}^{s} \qquad 4.18$$

The NEXR is determined by all variables and specifically by changes in the domestic nominal interest rate, according to the UIRP condition (Ali 2011).

$$(r_t - r_t^*) = (e_t{}^f - e_t) + \varepsilon_t \qquad 4.20$$

For example, an increase in the domestic interest rate will lead to an appreciation in the NEXR in a world with high degrees of capital mobility. The endogenous nominal flexible exchange rate is placed in the bottom row (Kim & Roubini 2000, 2008).

These latter three variables are potential instruments of monetary policy. While monetary policy will affect price level, fiscal policy will directly affect RNOGDP. Harmonisation between these policies is required, with fiscal policy primarily targeted to improve RNOGDP over the medium to longer run, while monetary policy is to leverage in the shorter to medium term, control over the domestic price level.

As in the previous models, the simple specification continues for the shocks to the SVAR in the following B matrix.

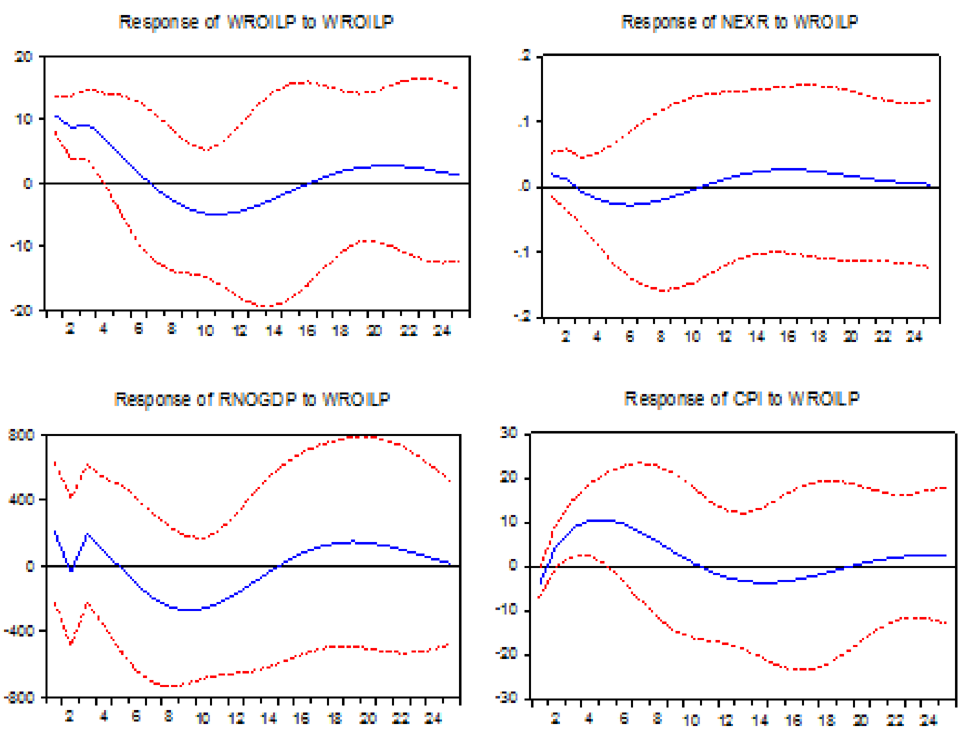
$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \\ \varepsilon_{7t} \end{bmatrix}$$

The specified SVAR model is overidentified with 67 zero restrictions and 7 unitary restrictions, a total of 74 imposed on the A_0 and B matrices. The requirement for $n = 7$ variables is $2n^2 - n(n+1)/2 = 70$, meaning the system is overidentified. The pre-test results of the VAR are included in the Appendix 7 in Tables A7.3.1 to A7.3.3. They show the optimum lag is 1, there is no serial correlation in the residuals and the model satisfies the stability condition. The SVAR estimations are detailed in the Appendix 7, Table.7.4.1. The simulations via the impulse response functions are explained in the following section.

7.3.2 SVAR monetary policy simulations

The IRFs in Figure 7.3.1 show that the Dutch disease of the previous two chapters exists in this extended model. The induced increase in RNOGDP is small and variable over the first five periods, and becomes negative over the next 10 periods. This follows the appreciation of the nominal exchange rate over the first 10 periods; CPI also increases over the same 10 periods.

Figure 7.3.1. Impulse response of real non-oil GDP, nominal exchange rate and CPI to an increase in the world oil price



Two monetary policy scenarios are considered to obtain insights into possible monetary policy responses to this world oil price shock. The first analyses a contractionary monetary policy via an increase in the domestic nominal interest rate to counter the upward effect on price. The second examines the expansionary depreciation of the flexible nominal exchange rate to stimulate real output.

However, as mentioned previously, monetary policy needs to be framed with fiscal policy, so it is instructive to examine the simulated effects of the world oil price shock on total real government spending, and subsequently, on other variables.

Figure 7.3.2 shows that the higher world oil price finances higher total real government spending in the short and medium term.

Figure 7.3.2. Impulse response of total real government spending to an increase in the world oil price

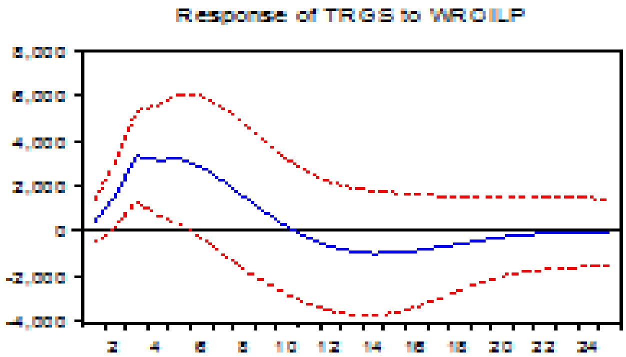
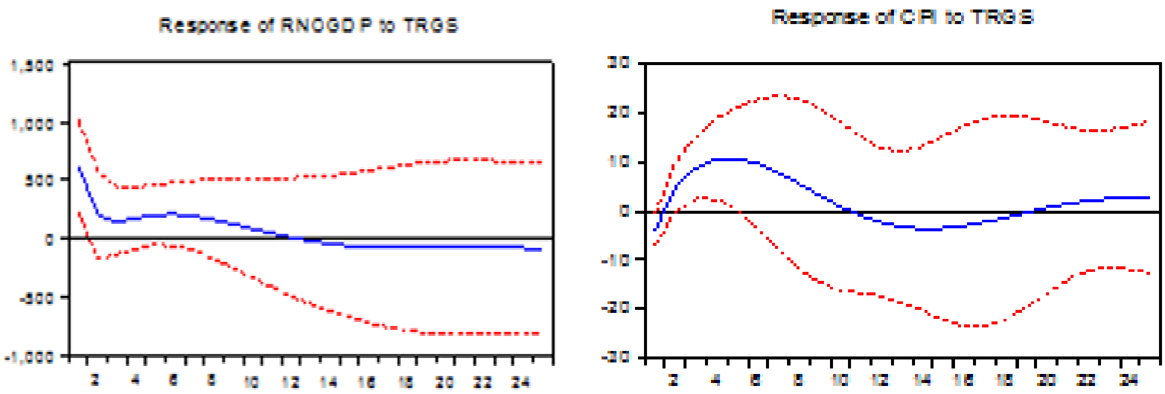


Figure 7.3.3 displays that higher real total government spending contributes to the increase in RNOGDP. This is over 12 periods, which is longer than the five-period increase created by the higher world oil price shown in Figure 7.3.1. Thus, it appears that the induced real fiscal spending successfully reduces Dutch disease effects on RNOGDP. However, this conclusion is not correct because the model provides further evidence that the increase in total real government spending appreciates the nominal exchange rate. This strengthens the Dutch disease effect, so there is two effects: exchange rate effect and spending effect of the Dutch disease, which reduces the overall stimulus to RNOGDP, in terms of magnitude and time periods, as shown in Figure 7.3.1. This confirms the necessity of distinction of the two government spending elements—government spending for consumption and government spending for investments—in the analysis of setting strategies of fiscal policy outlined in Section 7.2.2.

The effects on the price level of the world oil price increase and the induced increase in real fiscal spending are shown in Figures 7.3.1 and 7.3.3.

Figure 7.3.3: Impulse response of real non-oil GDP and CPI to total real government spending

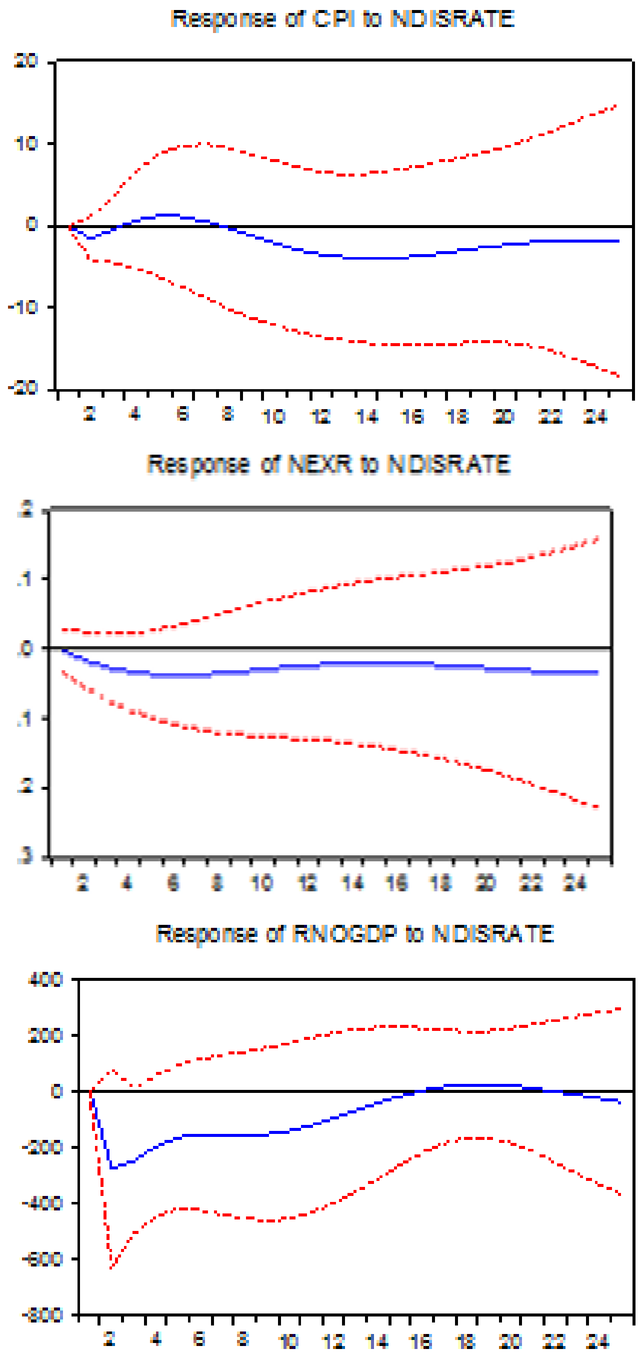


As explained in Chapter 6, the higher total government spending generates demand for tradeable and non-tradeable commodities in the non-oil sector. This, in conjunction with the relative lack of response of the supply side of the non-oil sector, will place upward pressure on the price level. This spending effect has strongly influenced the domestic price level in Libya. Therefore, monetary policy will now be considered in two cases. Case A (Section 7.3.2.1) examines the effects of a monetary policy increase in the domestic nominal interest rate by the central bank. Case B (Section 7.3.2.2) focuses on the effects of a monetary policy-induced depreciation of the nominal exchange rate.

7.3.2.1 Increase in the domestic nominal interest rate (Case A)

This case examines the response to a world oil price shock. It includes the induced expansionary fiscal expenditure and a countering contractionary monetary policy to reduce upward pressure on the domestic price. The objective of this investigation is to explore the extent to which increasing the domestic interest rate affects RNOGDP while reducing increases in the domestic price level. The overall effects of the world oil price increase on RNOGDP, the nominal exchange rate and the price level are shown in Figure 7.3.1; the induced fiscal expenditure is shown in Figure 7.3.2. The effects of the monetary policy response are depicted in Figure 7.3.4.

Figure 7.3.4. Impulse response of the CPI, nominal exchange rate and real non-oil GDP to an increase in the nominal interest rate

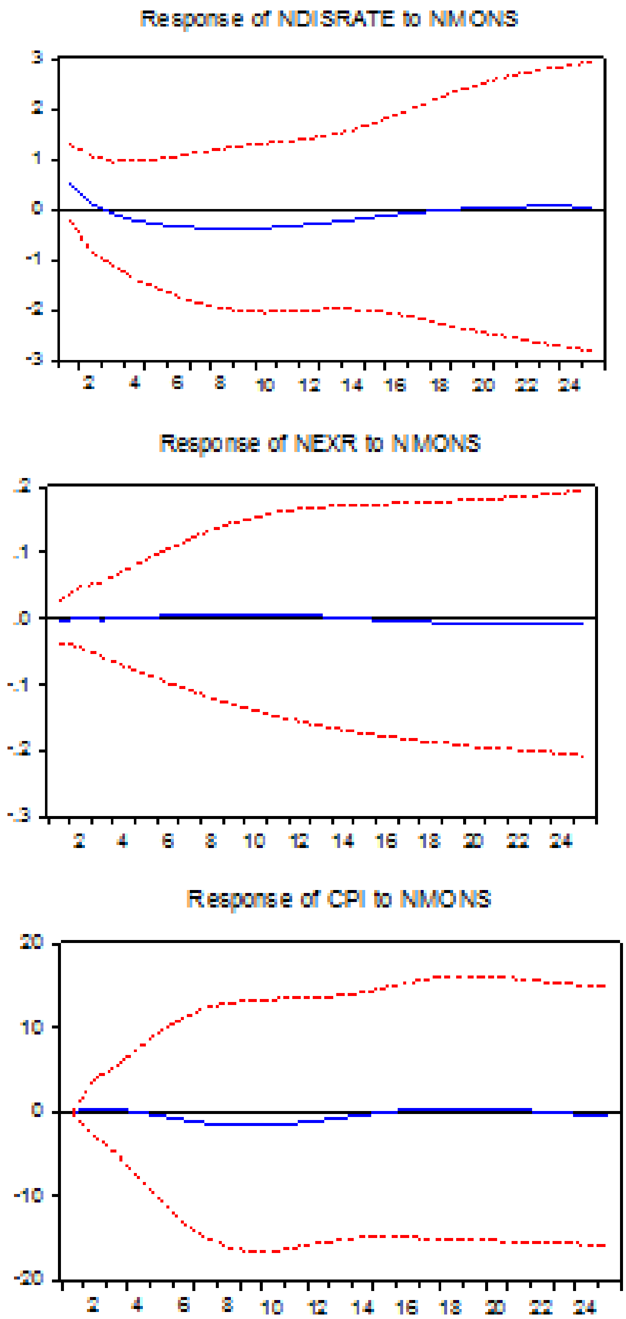


The impulse responses show the interest rate increase successfully dampens the effect on the CPI, which fluctuates mildly around a steady state and even declines in the medium to long term. However, there is a relatively small appreciation of the nominal exchange rate, particularly in the short run, due to the UIRP condition. This contributes negatively to aggregate demand, along with the higher domestic interest rate working through the interest rate channel, to reduce RNOGDP in the short to medium term. Therefore, it undermines the positive effects of real total government spending on RNOGDP over time.

The possible effects of changing the nominal money supply are shown in Figure 7.3.5; they are not particularly useful for policymakers. An increase in money supply leads to a slight reduction in the interest rate but has virtually no effects on the CPI and the nominal exchange rate. Given the financial and monetary sectors are in early stages of development, this result is not surprising. The central bank interest rate appears to be the more effective monetary policy instrument, particularly for the price level, and unfortunately, for RNOGDP in this case.

It can be concluded that this strategy has a reasonable effect in reducing the adverse effects on the CPI in the medium and long term. However, it causes a fall in RNOGDP due to appreciation in the nominal exchange rate. This is consistent with the findings and discussion in Section 6.3.4 and earlier chapters, which noted the importance of the exchange rate in influencing the domestic economy in developing countries. Therefore, Section 7.3.2.2 will investigate the induced fiscal spending under a world oil price shock with an expansionary monetary policy strategy of exchange rate depreciation to offset the Dutch disease effects on non-oil GDP.

Figure 7.3.5. Impulse response of the nominal interest rate, nominal exchange rate and CPI

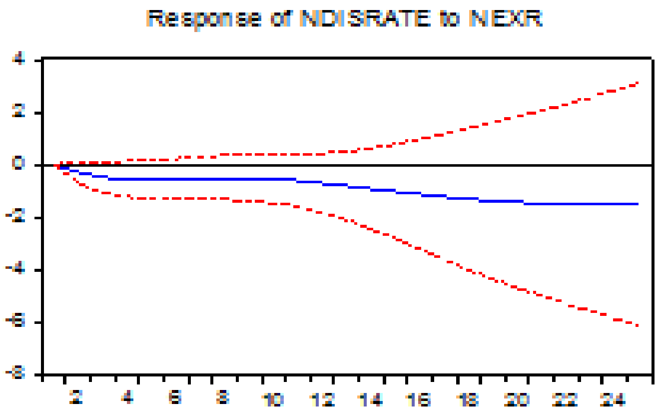


7.3.2.2 Depreciation of the nominal exchange rate (Case B)

This case is an extension to the second suggestion of Corden (2012) to lower the nominal domestic interest rate such that the nominal exchange rate depreciates, relieving Dutch disease effects. The parameters estimated and reported in Section B7.3 are used for the reported IRFs in this section.

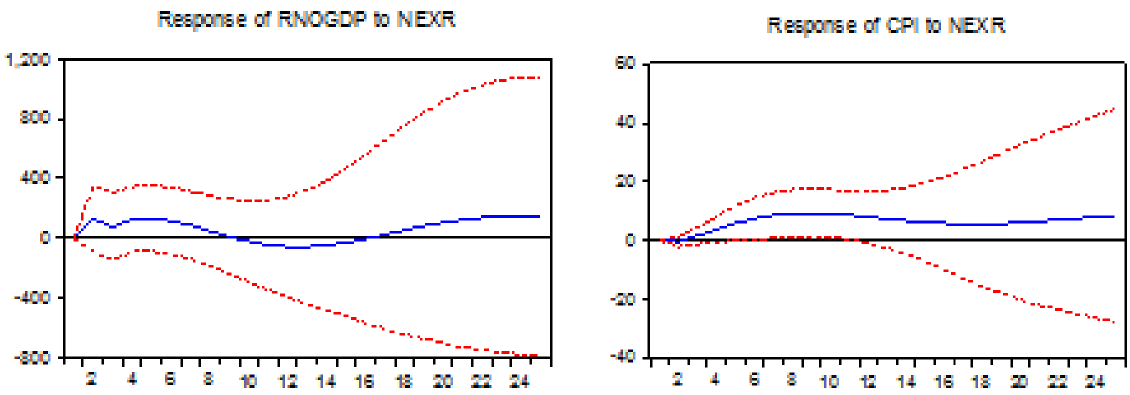
Figure 7.3.6 shows the effects of expansionary monetary policy with a lower nominal interest rate, an outflow of foreign exchange and depreciation of the nominal exchange rate.

Figure 7.3.6. Impulse response of nominal interest rate to an increase in nominal exchange rate (a depreciation)



The depreciation encourages demand for net exports and the lower interest rate encourages private sector demand for investment and consumption goods. These cumulative effects are displayed in Figure 7.3.7, with an improvement to RNOGDP in the short term. While this overcomes Dutch disease, the results shown are somewhat unexpected, in that the positive response of RNOGDP is not large, and is closer to its base value early by period 10. This could be due to the negative impact of higher domestic prices (see Figure 7.3.7) on the private sector. The increase in price level extends into the long run, and probably offsets the depreciated exchange rate and reduced interest rate stimuli.

Figure 7.3.7. Impulse response of real non-oil GDP and to a depreciation in the nominal interest rate



Overall, neither strategy considered here simultaneously improves both key macro-economic outcomes. The two monetary policy strategies using the nominal interest rate and the nominal exchange rate as instruments are unable to break the strongly identified link between RNOGDP and the CPI in the Libyan economy. A stimulus to real non-oil output increases the price level, while reducing the price level is at the expense of lower RNOGDP. Therefore, it is essential to tailor monetary policy, harmonised with fiscal policy, to break this trade-off. This will achieve stable output over an extended period, alleviating the adverse impacts of Dutch disease in oil-exporting economies such as Libya. Before further exploring possible calibration of short- to medium-term monetary policy, the simulations from Section 7.2 will be reconsidered as background to the long-term structural upward pressure on the price level.

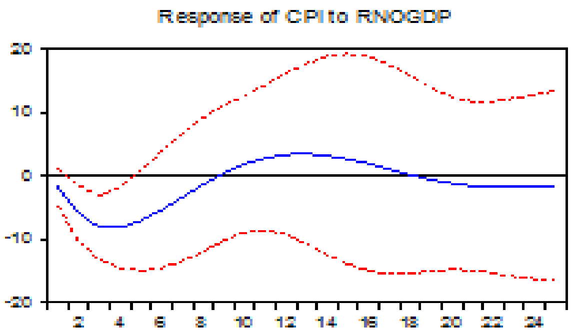
7.3.3 SVAR long-run fiscal policy and the price level simulation

The IRFs discussed in Section 7.2 indicate how non-oil output can be stimulated over time with fiscal policy, without increasing price level. That is, how it redirects fiscal spending from short-term public consumption to longer-term public investment. This, as explained in previous chapters, will increase human capital, physical plants and equipment, and infrastructure capital. The resulting increase in non-oil supply will place downward pressure on the price level, as can be observed in Equations (4.24) and (4.25) in Chapter 4. Combining these equations shows that price p_t is a function of the non-oil output gap No_t^{gap}, which is the difference between non-oil demand and supply

$$\sum_{i=1}^{K} a_{141}^{i} \left(No_{t-i}^{d} - No_{t-i}^{s} \right)$$

plus other factors, including the domestic currency price of oil $(e_t + po_t)$, the domestic currency price of the imported non-oil goods $(e_t + p_t^n)$ (which is represented by the imported goods price index in foreign currency multiplied by the exchange rate), inflation expectations π_t^e and the impact of oil price shocks po_t. The effect of reducing the non-oil output gap on the price level can be observed in the form of initial lower price in Figure 7.3.8. Therefore, non-oil output supply has an important role to play in influencing the domestic price. While the simulations indicate the short-term benefits, this effect will take considerable time when the lags associated with human, physical and infrastructure investment are explicitly specified.

Figure 7.3.8. Impulse response of the CPI to an increase in real non-oil GDP



As this capital formation process continues over time, the accumulated effect will place downward pressure on the price level. Having observed this long-term effect, the next section will return to focus on the short- and medium-term investigation of the effects of combining fiscal and monetary policies. Monetary policy will use a Taylor rule, with a flexible nominal exchange rate, to calibrate a response to the world oil price shock.

7.4 Taylor Rule-Based Monetary Policy Responses to a World Oil Price Shock Under a Flexible Nominal Exchange Rate

This section explores how the Taylor rule can be used to calibrate monetary policy responses to a world oil price shock. In doing so, it also attempts to harmonise with fiscal policy to reduce the effects of Dutch disease. As explained in Chapters 3 and 4, the Taylor rule has been successfully applied in monetary policy to simultaneously achieve stability in both closed and open economies (Leith & Wren-Lewis 2009).

The Taylor rule used here is for an open economy with a nominal interest rate, as well as the nominal flexible exchange rate used as monetary policy instruments. The second instrument is included because Libya is a small, open oil-exporting economy, and its exchange rate plays a vital role in influencing the economy. While some specifications of the Taylor rule include the NMONS, this will not be considered because the empirical analysis in Section 7.3 found that NMONS shows no significant direct links to RNOGDP and the domestic price level. As noted earlier, the effects of oil revenue foreign exchange earnings on the nominal money supply is sterilised with a floating exchange rate. However, fiscal policy in oil-exporting, developing countries such as those in the MENA region can, in terms of mostly funding government spending, subsequently affect domestic credit creation and therefore the money base. However, the transmission of changes in base money to broader monetary aggregates in the financial sector of this developing economy are not really known. Hence, the Taylor rule will consider the nominal interest rate and the nominal exchange rate rather than the nominal money supply as possible instruments of monetary policy.

The SVAR model used here extends the model in Section 7.3 to growth terms. This is because the standard formulation of the Taylor rule is in deviations of growth rates of objectives from targets (Dungy & Fry 2009; Kempa & Wilde 2011). The variables are defined and explained in Table 7.2. The respective growth in the world oil price (WROILPG), total real government spending (TRGSG), RNOGDP) and the price level (with standard term INF replacing CPIG) are calculated as the first difference of each logged variable. While these variables are in growth terms, the specification is not of a long-term growth model. The long-term effects of RNOGDP and the price level were considered in structural terms of the output gap in Section 7.3.3. Rather, this model is designed to analyse the short- to medium-term monetary policy effects on the preferred growth in RNOGDP and the targeted inflation rate, based on the short- to medium-term Phillips curve analysis. The nominal interest rate and exchange rate remain in levels since they are the monetary policy instruments used by the central bank.

The extended model uses the specific monetary policy Taylor rule, along with the fiscal expenditure channel. The behaviour of the nominal exchange rate in the Taylor rule model for an open economy is different from traditional exchange rate models. In standard flexible-price monetary models, higher prices (inflation) lead to a depreciation of the nominal exchange rate. Since the Taylor rule models the central bank's reactions, higher inflation precipitates a tightening of monetary policy. The increase in the nominal interest rate and appreciation of the nominal exchange rate pulls inflation back towards its target (Clarida & Waldman 2007, cited in Kempa & Wilde 2011).

Table 7.2

Description and Sources of Data for Taylor Rule Model

Variable	Description	Math Notation	Data Source
NDISRATE	Domestic nominal interest rate	r_t	WB- CBL
NEXR	Nominal flexible exchange rate	$\mathrm{e_t}$	WB-CBL-IMF
WROILPG	Growth in the world oil price (*Dlog* WROILP)	$\dot{po}_t = \partial po_t / \partial t$	WB- OPEC
INF	Growth in the CPI (*Dlog* CPI)	$\pi_t = \dot{p}_t = \partial p_t / \partial t$	WB-CBL
RNOGDPG	Growth in real non-oil GDP (*Dlog* RNOGDP)	$\dot{y}_t = \dot{No}_t^s = \partial No_t^s / \partial t$	WB- CBL-IMF
TRGSG	Growth in total real government spending (*Dlog* TRGS)	$\dot{g}_t = \partial g_t / \partial t$	WB- CBL-IMF

Note: These variables are generated from the data reported in Table 7.1 using EViews 8. The SVAR and VAR estimations, including the IRFs, are calculated using EViews 10.

These extended features of the Taylor rule are included in the more recent generations of Taylor rules applied to open, oil-exporting, developed economies, such as Norway. This section attempts to exploit these features for Libya, an oil-exporting developing country in the MENA region, to alleviate the adverse impacts of Dutch disease and achieve stable economic growth and inflation. As explained in Chapter 2, these outcomes have been sadly lacking in Libya. Section 7.4.1 explains the specification and identification of the SVAR model.

7.4.1 SVAR specification and identification

The SVAR is based on the model used in Section 7.3, with the nominal money supply excluded because of its lack of influence on other macro-economic variables. The remaining six variables are included in the X_t vector below. The world oil price and total real government spending are in growth rates, the RNOGDP growth rate and inflation rate are deviations from their target rates, $\dot{y}_t^*$ and π_t^*, indicated by the asterisk superscripts. The nominal interest rate and exchange rate Taylor rule policy instruments remain in levels.

The A_0 matrix is specified similar to the previous model. The growth in the world oil price is assumed exogenous and the subsequent oil revenue effects directly influence growth in total real government spending. These variables are consequently placed in the first two rows; they in turn affect the deviations in policy growth variables of RGDP and inflation from their target growth rates in the third and fourth rows. The zero restriction assumes that the effect of fiscal spending does not contemporaneously affect the real non-oil output growth. Rather, this effect is expected to operate with a lag.

The otherwise unrestricted recursive system in the remaining rows of the A_0 matrix indicates the specification of the generalised form of the Taylor rule, as discussed in Chapters 3 and 4. Since Libya is a small, open economy, the model incorporates the conceptualised versions of the Taylor rule expressed by Ball (1999), Svensson (2000), Taylor (1999b, cited in Taylor 2001) and extended by Balabay (2011), as shown in Chapter 4 Equation (4.24),.

$$\lambda_0 r_t - (1-\lambda_0)e_t = \rho r_{t-1} + \alpha(\dot{y}_t - \dot{y}^*) + \beta(\pi_t - \pi^*) + \lambda_1 e_{t-1} + \gamma \dot{po}_t + \delta \dot{g}_t + b_{66}\varepsilon_{6t}$$

Given the importance of fiscal spending detected in the previous sections of this chapter, it is interesting to assess if it should be a determinant of monetary policy. The estimate of the parameter δ will indicate its relative importance in affecting the instruments. These parameters are included in the SVAR.

$$A_0X_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & 0 & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ \gamma & \delta & \alpha & \beta & -\lambda_0 & 1 \end{bmatrix} \begin{bmatrix} WROILPG \\ TRGSG \\ RNOGDPG - \dot{y}^* \\ INF - \pi^* \\ NDISRATE \\ NEXR \end{bmatrix}$$

Since this is exploratory research, the Taylor parameter restrictions mentioned in the literature will not be imposed. For example, Taylor (1993, 2001) argued that rules placing equal weight on both output growth and inflation gaps would perform better than rules with differing weights including only the output gap or inflation gap. Rather, all these parameters in the A_0 matrix are unrestricted and will be determined according to the data.

For this model, the study imposes a target growth of 7% per annum for real non-oil output growth and 5% for inflation, that is $y^* = 7$ and $\pi^* = 5$. These target percentages are considered the most likely to achieve stable economic growth in oil-exporting countries in the MENA region, including Libya. Most developed or industrialised economies focus on inflation rate targeting between 1–3%. This inflation target has resulted in better economic growth for many developed economics. Developed countries have greater transparency in the monetary policy system and institutions' credibility, so positive economic growth has been achievable with this target (Khan & Senhadji 2001; Ayisi 2013; Bhandari & Frankel 2017). Developing countries that suffer from a lack of accuracy and credibility in monetary policy systems, an absence of credible institutions, or political pressure to finance budget deficits have histories of high inflation (Bhandari & Frankel 2014, 2017). Hence, most developing countries that experience the inflation target estimated the inflation target at a minimum of 11%; this percentage negatively affects economic growth. This has been confirmed many studies on developing countries, including oil-exporting countries (Khan & Senhadji 2001; Frimpong & Oteng-Abayie 2010; Quaerty 2010, Hasanov 2013; Espinoza et al. 2010; Ayisi 2013; Kremer et al. 2013. Sarel (1996) and Phiri (2010) found that an 8% inflation target for developing countries shows a slightly positive effect on economic growth compared with 11%.

Anwar and Islam (2011) based on IMF (2005), Independent Evaluation Office (2007) and Global Monitoring Report (2011) documents recommended that policy statements on inflation target should target medium inflation 5–5.5% to achieve medium real GDP growth around 6.5–7.7%. Therefore, the current study targets RNOGDP growth at 7% and the inflation rate at 5%. These target percentages are also considered the most likely to achieve stable economic growth in oil-exporting countries in the MENA region, including Libya (World Bank Report Country 2016). The targets in the current study are split between inflation and RNOGDP growth, rather than a focus on one alone, which would ignore the impact of the other.

According to Bhandari and Frankel (2014, 2017), the choice of target variable is based on the kind of shock that the nation faces and the impact on key macro-economic factors, such as RGDP growth and inflation. For example, an inflation target is preferred by developed economics such as the US, UK and Euroland, which have credible monetary expansion, commonly including a rise in expected inflation to avoid economic weakness. While the target of nominal GDP is more appropriate for middle-sized Asian economies that often face supply shocks such as weather-related disasters, the current target has been designed to focus on two digits of targets, RNOGDP growth and inflation rate, since oil price shock influences both RNOGDP (and growth) and domestic prices (and/or inflation) in Libya. This study aims to achieve better and stable economic performance in terms of RNOGDP growth and inflation, which is significantly affected by oil price shock in the case of Libya.

The shocks to each SVAR equations can differ across each equation, according to the b_{ii} in the B matrix. However, the zero restrictions only allow each shock to contemporaneously affect its own equation, with a cross-equation effects occurring with a lag.

$$B\varepsilon_t = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \\ \varepsilon_{6t} \end{bmatrix}$$

The required number of restrictions for identification is $2n^2 - n(n+1)/2$ = 51 for $n = 6$ variables. This is equal to the sum of the 21 restrictions in the A_0 matrix and the 30 zero restrictions in the B matrix. Therefore, the model is exactly identified.

7.4.2 SVAR short-term Taylor rule simulations

The result of the preliminary tests reported in the Appendix 7 Tables indicates a single lag is optimal for the VAR and there is no serial correlation in the residuals. The model also satisfies the stability condition, with two imaginary eigenvalues providing oscillatory dynamics and three real eigenvalues, all of which are well less than unity (lie within the unit circle). However, there is one real eigenvalue, which has modulus 1.07. This can possibly indicate a move to a new long-term cointegrating steady state (see Chapter 5) but the focus here is on the short to medium-term. This value indicates only mild instability in one of the six measures, which is expected to be possibly be in the world oil price inflation or domestic inflation variable.

The IRFs show how the specified Taylor rule instruments adjust to the effects of a shock to the growth in the world oil price on the target variables. For simplicity, the target variables will be denoted by $RNOGDPGT = NROGDPG - \dot{y}^*$ and $INFT = INF - \pi^*$.

The temporary one-off shock is a positive one-standard deviation change in the first period, which falls to zero very quickly according to Figure 7.3.9. As in Section 7.4.1, this generates an increase in growth of total real government spending over the first couple of periods. Figure 7.3.10 shows an initial increase in RNOGDP growth above the target 7% rate. However, this is only in the first two periods and there is no inflationary pressure above the 5% target.

Figure 7.3.9. Impulse responses of the growth in total real government spending to the shock in the world oil price growth

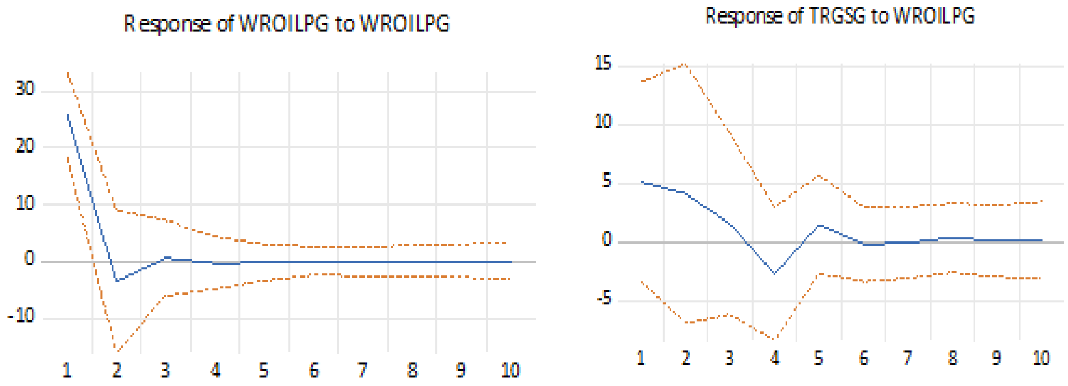
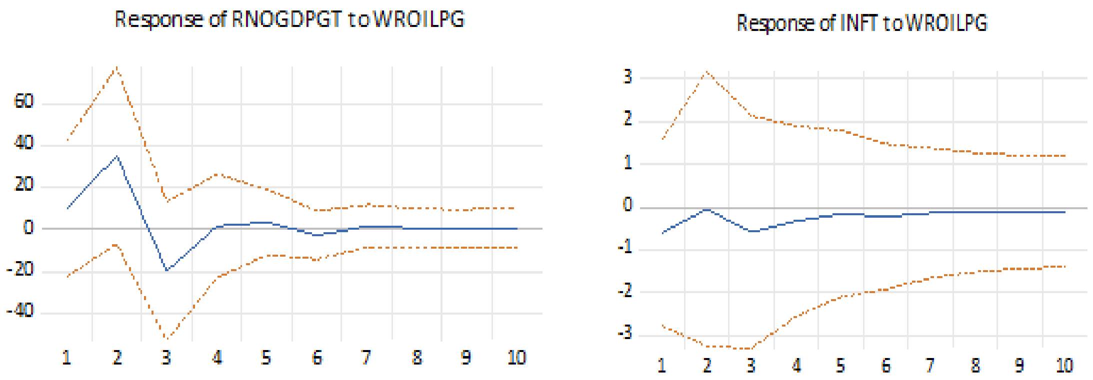
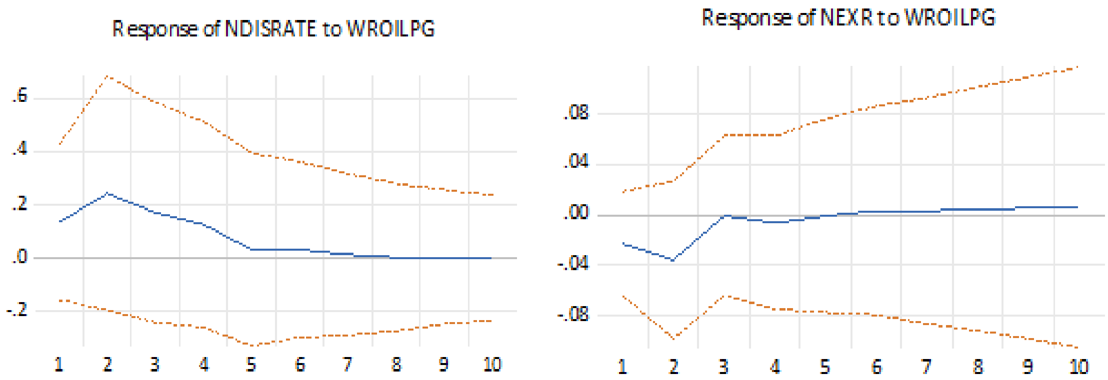


***Figure 7.3.10.* Impulse responses of real non-oil GDP growth and inflation gaps to the shock in the world oil price growth**



The reason for these results is in the working of the instrument responses according to the Taylor rule, as demonstrated in Figure 7.3.11. The nominal interest adjusts immediately by increasing in the first period and continues above the steady state value for four periods. The nominal exchange rate appreciates in the first two periods, and depreciates back to its steady state. There is a negative reaction to RNOGDP growth in Figure 7.3.10, which subsequently falls below its target in period 3, due to these instrument responses. However, this is short-lived, as the depreciation in period 3 leads to the increase in the RNOGDP growth rate back to its target value in the fourth period. The nominal interest rate subsequently reduces to its steady state value in period 5.

Figure 7.3.11. Impulse responses of Taylor rule nominal interest rate and the exchange rate instruments



These simulations clearly show that Dutch disease is not allowed to develop with the induced appreciation of the nominal exchange rate being reversed by the Taylor rule within three periods. Therefore, the adverse effect on the real non-oil output growth gap does not eventuate. The interest rate increases immediately to offset increased growth in the world oil price and is maintained to control the continuing increased growth in total real government spending. This anti-inflationary response is maintained to also offset the stimulatory effects of the subsequent depreciation of the exchange rate. The successful interaction between these monetary policy instruments supports the MCI specification of the Taylor rule, incorporating both interest rate and exchange rate instruments. They also harmonise with fiscal policy to stop the adverse output effects from the appreciation of the exchange rate, while simultaneously controlling inflation.

Table 7.3 shows the estimated responses of Taylor rule instruments, the domestic nominal interest rate and the nominal exchange rate, to deviations in RNOGDP growth and inflation rates from their target values. These estimates are taken from the bottom two rows of the A_0 matrix in the SVAR, so they are within-period reactions. Responses to world oil price inflation are also included. Since none of the responses to the growth in real government spending are significant, they are not included. Noting the arguments in

Chapter 5 that these estimates need to be interpreted with care because the small sample properties are unknown, they are considered in these explorations for guidance only. SVAR estimates show the exchange rate can be a significant instrument, appreciating by 0.001 when the RNOGDP growth rate exceeds its target value by a larger 0.007 for inflation, exceeding its target. The responses of the interest rate are larger in value but are not significant. However, the estimates from the VAR show the one-period lagged response of the interest rate to inflation deviations from target is 0.051. This is significant at the 1% level and similar to the within-period value of 0.048 (significant at 10%) in Table 7.3. Moreover, the SVAR estimate shows the interest rate is directly sensitive to the world oil price, increasing by nearly 0.004 in the period that the shock occurred at the 5% level of significance. Greater importance appears to be given to the interest rate in controlling the world oil price and domestic price inflations. Conversely, the exchange rate is focused on domestic targets for RNOGDP growth and domestic inflation. This is not unexpected given the primary focus and purpose of monetary policy in the short to medium term is to control inflation.

Table 7.3

The Contemporaneous Responses of Taylor Rule Instruments to Changes in Macro-economic Outcomes

Instrument response	Target variables		Exogenous shock
	RNOGDPGT	INFT	WOILPG
	α	β	γ
NDISRATE	0.0022	0.0483*	0.0037**
NEXR	–0.0010***	–0.0074***	–0.0008

Note: Z tests of contemporaneous significance * Significant at the 10% level.
** Significant at the 5% level *** Significant at the 1% level.

In summary, the dynamic IRFs show that monetary policy operates remarkably well in response to a world oil price shock. These simulations use the theoretically based Taylor rule, operating with a flexible exchange rate regime in a simultaneous system including fiscal expenditures. The results indicate that the nominal exchange rate plays a vital role, along with the domestic interest rate, in responding to changes in RNOGDP and inflation due to the shock in the world oil price and induced changes in total government spending. The dynamic Taylor rule analysis provides meaningful results that provide monetary policy principles in setting the interest rate and exchange rate responses to overcome Dutch disease and inflation. It captures the dynamic changes in RNOGDP growth and inflation, through which they return to their steady-state target values, especially later in the short term, to be stable in the medium term. This can be used to provide stable non-inflationary economic growth for Libya. This result is in line with the suggestions of the IMF (2003, 2008) and World Bank (2016), discussed in Chapter 2, to overcome these major issues for the Libyan economy.

7.5 Summary and Conclusion

The aim of this chapter has been to empirically investigate alternative fiscal and monetary strategies, proposed in previous chapters, to determine the extent to which they mitigate the adverse impacts of a world oil price shock and ensuing Dutch disease in a small, open, oil-exporting economy such as Libya. It extends the empirical work in Chapter 6 by analysing the interaction of macro-economic policies operating under a flexible exchange rate regime. This chapter comprises three complementary explorations.

The first, in Section 7.2, focuses on possible fiscal policy responses to Dutch disease caused by a world oil price shock. The SVAR simulations, using nine variables, show increased oil revenues fund increases in fiscal spending. Therefore, two cases of fiscal spending are analysed under a flexible real exchange rate. The first assumes the increase in real government spending comprises consumption rather than investment expenditure. The simulations show this decreases real private consumption expenditure in the short term, and real private investment in the short to long term. This real public consumption spending 'crowding out' real private spending causes RNOGDP to fall in the short to medium term. The price level increases over this same period, causing stagflation. In comparison, if the increase in oil revenue is used to increase real government investment spending, this strategy increases overall real private sector expenditure.

The simulations for this second case show a resulting increase in real private consumption spending in the short term and investment spending over the short to longer term. The private sector benefits from increased real government investment spending, which increases capital stock. RNOGDP subsequently increases in the short to medium term. The price level initially falls but then increases over the medium term due to this real public investment spending 'crowding in' real private spending.

These remarkable results provide strategies for policymakers in Libya to operationalise Corden's (2012) argument to move the fiscal budget in the surplus direction to reduce Dutch disease effects. The evidence in this section supports reducing real public consumption expenditure rather than real public investment expenditure. Indeed, public investment may even be increased if it is substituted for public consumption. This can provide strategic capital formation to improve human, physical and infrastructure capital. This may reduce pressure on the price level. However, this will take time and the increase in price remains an issue. Accordingly, monetary policy must be included in the analysis.

Section 7.3 examines how best to coordinate fiscal and monetary policies to achieve better outcomes in terms of RNOGDP and the price level for Libya. Central to this analysis is the continued inclusion of a flexible exchange rate: the nominal rate (relevant for monetary policy) rather than the real rate. The effects of the world oil price shock are explored with two different monetary policy responses then a fiscal response, with a SVAR model containing seven variables. Fiscal policy is included in terms of total real government spending (remembering the lessons from Section 7.2 on the importance of the composition of this spending). As previously discovered, world oil price shock increases fiscal spending, which in turn increases RNOGDP and price level in the short term. The first monetary policy response considered is an increase in the nominal interest rate to reduce inflation. The simulations show this is highly successful in keeping the price level from increasing in the short to long term. However the contractionary monetary policy appreciates the nominal exchange rate in the short term, and along with the higher interest rate, these two channels reduce RNOGDP in the short to medium term. Thus, the simulations show this policy controls the price level but worsens the Dutch disease effect.

The second monetary policy case analyses the effects of a depreciation of the nominal exchange rate to offset the Dutch disease effect, hopefully not at the expense of increasing the price level. However, the depreciation only induces a small increase in RNOGDP and only in the short run, despite the induced increase in real total fiscal spending. Moreover, there is an increase in the price level. Although this increase is relatively small, it is persistent, continuing into the long term. Given this persistence in increasing price and the unfortunate trade-off between higher (lower) RNOGDP and higher (lower) price, the result in Section 7.2 is reviewed in terms of fiscal spending on investment in human capital, physical plant and equipment, and strategic infrastructure. The simulations show that increasing non-oil GDP will reduce the output gap and place direct downward pressure on price. However, the supply side effects from the capital formation will take time. This refers to the analysis in Chapter 6, in which monetary policy under a managed exchange rate regime in Libya was analysed. In that case, it was inferred that increasing price is a structural issue more than a monetary issue. In any case, there is the long-term solution to overcome the trade-off between RNOGDP and price. However, this needs to be attempted in the short to medium term.

Section 7.4 attempts to break the trade-off in the short term using monetary policy. The world oil price shock and induced increase in fiscal spending needed to be controlled by monetary policy. Central to this is the need to use two instruments to achieve the two policy goals. This is done in the form of the MCI of an extended Taylor rule, in which both the nominal interest rate and exchange rate are simultaneously determined in response to the world oil price shock to achieve increased RNOGDP with stable prices. The Taylor rule is dynamically specified in terms of minimising the deviations of the growth in RNOGDP and the inflation rate from their respective target rates of 7% and 5%.

Consistent with the findings in Section 7.3, the six variable SVAR simulations show the shock to the growth in the world oil price increases growth in total real government spending and initially increases RNOGDP growth above target. These increases are limited to the short term, extending to over only a couple of periods. Surprisingly, this is not followed by the negative Dutch disease effect on growth of RNOGDP. It does not eventuate; its growth returns to the target rate of 7% in the short term, remaining there into the medium term. Importantly, inflation does rise above target for the whole period, from the short to medium term. The reason for this breakdown in the trade-off is the dual use of monetary policy instruments via the Taylor rule. The nominal interest increases immediately, appreciating the nominal exchange rate. Both these responses control inflation. The exchange rate then depreciates back to its steady state to counter the negative effect on the growth in RNOGDP, which subsequently returns to its target growth rate. Once the system is stabilised, the nominal interest rate quickly reduces back to its steady state value in the short term. These remarkable dynamic simulations, based theoretically on the extended Taylor rule with a flexible nominal exchange rate and fiscal expenditure, provide a framework for short-term monetary policy to help overcome Dutch disease and ensure price stability in Libya.

The main conclusions of the dynamic simulations of this chapter are first, that Libya needs to redirect fiscal expenditure away from consumption and towards strategic investment spending. This long-term strategy should aim to improve productivity in the non-oil sector and reduce inflationary pressure. Second, in the case of a world oil price shock, consistent with Corden (2012), the appropriate short-term fiscal response is that increased fiscal spending should be designed to reduce public consumption spending and move the fiscal budget towards a surplus. A Taylor rule should be used as the basis of short-term monetary policy to limit the increase in the nominal interest rate and counter the appreciation of the flexible nominal exchange rate. This coordination of these instruments will reduce Dutch disease effects in the short to medium term, and help achieve stable economic growth.

Chapter 8 will summarise the important findings of the thesis and provide important insights for policymakers on the adjustment processes involved and the consequences of alternative policy scenarios in response to world oil price shocks and Dutch disease. These lessons mitigate the adverse impacts of Dutch disease on small, open oil-exporting developing economies such as that of Libya.

Chapter 8: Summary and Recommendations

8.1 Introduction

This study sought primarily to investigate the impact of oil price shocks on domestic economies by analysing key macro-economic variables and macro-economic policy responses. While data from Libya were specifically utilised and analysed, findings are applicable more broadly to countries of the MENA region. Oil-exporting countries of the MENA region have borne the problems associated with Dutch disease, which has lingered for a prolonged period. Libya is not an exception because, as this study reveals, it has maintained a high rate of production and exportation of oil while enduring imbalanced growth of real output and inflation. It has been observed that, from the start of the exportation of oil from Libya in 1961 to the present, the country has depended on the contribution of the oil sector to support real output, as there is no significant contribution from other major sectors, such as infrastructure or manufacturing. Therefore, it is believed by many economists that Libya is a textbook example of the resource curse, especially Dutch disease.

Dutch disease has been burdensome to the overall economy. Specifically, higher foreign exchange earnings arising from higher oil prices, and higher oil exports appreciating the real exchange rate, adversely affects real non-oil trade. It erodes real non-oil output, a curtailment associated with the spending effect on domestic prices. A main justifications of this study is the need to analyse and understand the macro-economic policies that worsen under oil price shocks and the domestic economies of the oil-exporting countries of MENA. The employment of key macro-economic factors, including real non-oil growth and inflation, are essential inclusions if seeking to understand and address the issues holistically. This study contributes to the literature and to macro-economic governance more broadly by gathering evidence directed towards fiscal and monetary policy, with consideration of exchange rate regimes, to evaluate strategies critically. In so doing, more capable policies to mitigate the adverse impact of Dutch disease are proposed. The study developed and extended theoretical macro-economic empirical SVAR models and techniques by using available Libyan data for 1980–

2016. The contemporaneous and dynamic behaviour of these models is examined. Simulation of the effects of external oil price shocks to the domestic economy and related macro-economic responses revealed significant findings. Section 8.2 discusses the main findings of this study by linking these to the research hypotheses introduced in Chapter 1.

8.2 Research Hypotheses and Summary of Main Findings

This thesis analyses the existence and the effects of Dutch disease on the Libyan economy. The research hypotheses used to test and analyse the issue are each considered,

Hypothesis 1: Dutch disease exists in Libya, whereby an oil price shock appreciates the real exchange rate and worsens real output and domestic prices.

To examine this hypothesis, the study analyses two models that include key factors directly related to pure Dutch disease (see Chapter 5). These factors are the world oil price, real effective exchange rate (nominal exchange rate adjusted for trade prices), real GDP, real non-oil GDP and domestic prices (CPI) over the years 1980–2016. The two models include a managed exchange rate system, which has operated in Libya, and excludes fiscal and monetary policies.

The study ran SVAR simulations for the two models. Model 1 shows an adverse impact of oil price shock on total real GDP (including both oil and non-oil GDP) and increased domestic prices. For Model 2, the oil price shock adversely effects real non-oil GDP, which is larger than the adverse effect on real GDP in Model 1. It is shown that these effects come about by an induced appreciation of the real exchange rate in the short to medium term, which adversely affects real output, particularly in the non-oil sector over these periods. This ultimately overcomes the positive effect of the increased oil price on total real GDP, forcing it to decline in the medium run. The higher world oil price transmits through to higher domestic price for both models and this contributes to the real appreciation, with a managed nominal exchange rate.

Based on this evidence, Hypothesis 1 cannot be rejected. Dutch disease exists in the Libyan economy.

Hypothesis 2A: Increasing the fiscal budget surplus in Libya counters Dutch disease effects under a managed nominal exchange rate regime.

Hypothesis 2A is related to the examination of the oil prices shock and the response of current fiscal policy under a managed exchange rate. To analyse this hypothesis, this study simulated a SVAR model, based on the theoretical model in Chapter 4, which included six variables: world oil price, real fiscal budget balance, real effective exchange rate, real non-oil trade balance, real non-oil GDP and the CPI. The study employs the real fiscal budget as a critical channel of fiscal policy and crucially includes a managed exchange rate (see Chapter 6). The main findings are summarised as follows.

The first of three simulations explored the dynamic existence of Dutch disease. It finds that the shock to the world oil price appreciates the real effective exchange rate in the short term. The real non-oil trade balance responds by moving into deficit over this same period. The initial stimulus to real non-oil GDP, caused by the world oil price increase, subsequently diminishes over the short run and becomes negative in the medium term. This further evidence of Dutch disease in Libya adds supports the robustness of the findings in Chapter 5 and the conclusion regarding Hypothesis 1.

The second simulation investigates the relationship between responses in the real fiscal budget and real non-oil trade balances to the oil price shock. The real fiscal budget moves into surplus due to the oil revenue effect from the world oil price shock for only a few periods. It then rapidly declines into deficit and remains in deficit into the medium term. The impact of a positive world oil price shock also leads to a decline in the real non-oil trade in the short and medium terms. The dynamic concurrence of deficits in the both the real fiscal budget and real non-oil trade balances is evidence of the twin deficits hypothesis. However, there is also an increase in the domestic price level in the long term. This is unsurprising given the world oil price shock and increasing fiscal deficit funded by money creation in the increased foreign exchange oil revenue.

The third simulation examines the response of the real effective exchange rate to moving the real fiscal budget into surplus. This tests the first recommendation of Corden (2012) to alleviate Dutch disease impacts. The simulations show that a real fiscal budget surplus depreciates the nominal exchange rate, which quickly moves the real trade balance into surplus. Real non-oil GDP and the trade balance move quickly to steady state. These results demonstrate that, in response to a positive world oil price shock, moving the fiscal budget into surplus pulls the non-oil trade deficit into surplus, which overcomes Dutch disease effects and the twin deficits problem. However, it fails to control higher domestic prices in the short term,

According to the above evidence, Hypothesis 2A cannot be rejected. Increasing the fiscal budget surplus in Libya counters Dutch disease effects under a managed nominal exchange rate regime, although increased prices remain an important issue.

Hypothesis 2B: Reducing the domestic interest rate with expansionary monetary policy in Libya counters the Dutch disease effects for a managed nominal exchange rate.

The second model in Chapter 6 focuses on monetary policy and replaces the fiscal and trade variables with a nominal domestic interest rate and nominal money supply. The managed exchange rate assumption remains, but the real rate is replaced with the nominal exchange rate. The seven-variable SVAR model was simulated three times.

The first simulation indicate that the world oil price shock appreciates the nominal exchange rate and worsens RNOGDP, again confirming the presence of Dutch disease. However, the nominal appreciation over the short term is relatively smaller than in the previous fiscal model. This reflects the inclusion of the nominal exchange rate, which is managed by the Central Bank of Libya (CBL) and is therefore less flexible than the real effective exchange rate included in the fiscal model. Despite this, the reduction in real non-oil GDP extends from the short into the medium term. The nominal domestic money supply also increases over the short to medium term due to the foreign exchange inflow from additional oil revenue with a managed nominal exchange rate. The CPI appears to respond closely to the endogenous increase in money supply over the sample period.

The second simulation continues to examine external factors in terms of the world oil price shock on the US Federal Funds rate (FFR) and the transmission to the nominal domestic interest rate. The FFR responds positively to the world oil price shock in the short to medium term, presumably because of contractionary monetary policy in the US. However, the response of the domestic nominal interest rate is lagged, confined to the short term and relatively small. So, the transmission of the world oil price shock to the Libyan economy via the US and domestic interest rates is not close or effective. The uncovered interest rate parity condition (UIRP) does not hold due to restrictions on international capital movements and the CBL's management of the nominal exchange rate.

The breakdown in UIRP gives the CBL scope to manipulate the domestic nominal interest and nominal exchange rates separately. The final simulations analysed the effectiveness of these two possible monetary policy instruments to offset the effects of the world oil price shock. Simulating the lowering of the domestic interest in response to the oil price shock depreciates the exchange rate, but unfortunately, it has very little effect on real non-oil GDP over the sample period. This lack of an effective interest rate channel means that this is not a useful instrument to offset Dutch disease effects.

However, the simulation of a direct depreciation conducted by the CBL is more effective. Real non-oil GDP responds by rapidly increasing in the short term and diminishing in the medium term as the depreciation moderates. This monetary policy instrument has the potential to offset Dutch disease arising from a world oil price shock, but it also leads to endogenous increase in domestic money supply over the medium term, and in the CPI in the long term.

In summary, Corden's (2012) second recommendation to reduce the domestic interest rate in response to the world oil price shock is not found to be successful using the Libyan data. Therefore, based on these findings, Hypothesis 2B can be rejected.

While this is also important in identifying appropriate monetary policy instruments, there is the remaining issue that the successful depreciation does increase domestic money supply and the price level. Central to the fiscal and monetary policies analyses for Hypotheses 2A and 2B, is the managed nominal exchange rate by the Libyan authorities. The other issue is how best to move the real fiscal budget into a surplus direction. These important policy considerations are included in the remaining hypotheses.

Hypothesis 3A: Fiscal investment spending is more effective than fiscal consumption spending in countering the effects of Dutch disease under a floating exchange rate.

To examine this hypothesis, the study ran two models employing government consumption and government investment spending in Chapter 7. This was conducted with the world oil price, real money supply, real private consumption and real private investment spending, real non-oil trade, real non-oil GDP, the CPI and the real effective (not nominal) exchange rate. Importantly the SVAR specifies the exchange rate as flexible. The SVAR simulations show increased oil revenues fund increases in fiscal spending. So, two cases of fiscal spending are analysed.

The first simulation assumes the increase in real government spending comprises consumption rather than investment expenditure. The simulations show this decreases real private consumption expenditure in the short term, and real private investment in the short to long term. This real public consumption spending 'crowding out' real private spending causes real non-oil GDP to fall in the short to medium term. The price level increases over this same period, causing stagflation.

The second simulation directs the increase in oil revenue to real government investment spending. This results in increasing real private consumption spending in the short term and real private investment spending over the short to longer term. The private sector benefits from increased real government investment spending, which increases capital stock. Real non-oil GDP subsequently increases in the short to medium term. The price level initially falls but then increases over the medium term due to this real public investment spending 'crowding in' real private spending.

These results provide strategies for policymakers in Libya to operationalise Corden's (2012) recommendation to move the fiscal budget in the surplus direction to reduce Dutch disease effects. The evidence supports reducing real public consumption expenditure rather than real public investment expenditure. Indeed, public investment may even be increased if it is substituted for public consumption. This can provide strategic capital formation to improve human, physical and infrastructure capital. Hence, Hypothesis 3A cannot be rejected. The remaining issue is of the pressure to increase the price level in these simulations. Accordingly, monetary policy must be included in the analysis of how to overcome the Dutch disease effects without increasing prices.

Hypothesis 3B: Expansionary monetary policy is more effective than contractionary monetary policy in countering Dutch disease effects under a floating exchange rate.

Chapter 7 examines how best to coordinate monetary policy with fiscal policy operating under a flexible nominal exchange rate (relevant for monetary policy). The effects of the world oil price shock are explored with two different monetary policy responses then a fiscal response, with a SVAR model containing seven variables. Fiscal policy is included in terms of total real government spending (recognising the evidence above of the importance of the composition of this spending). As previously discovered, world oil price shock increases fiscal spending, which in turn increases real non-oil GDP and price level in the short term. The first monetary policy response considered is an increase in the nominal interest rate to reduce inflation. The simulations show this is highly successful in keeping the price level from increasing in the short to long term. However the contractionary monetary policy appreciates the nominal exchange rate in the short term, and along with the higher interest rate, and these two channels reduce real non-oil GDP in the short to medium term. Thus, the simulations show this policy worsens the Dutch disease effect but controls the price level.

The second monetary policy simulation analyses the effects of a depreciation of the nominal exchange rate to offset the Dutch disease effect. However, the depreciation only induces a small increase in real non-oil GDP and only in the short run, despite the induced increase in real total fiscal spending. Moreover, there is an increase in the price level. Although this increase is relatively small, it is persistent, continuing into the long term. Whilst there is some mixed evidence, in terms of an improvement in non-oil GDP, Hypothesis 3B cannot be rejected. The issue of increasing price remains.

Hypothesis 3C: A Taylor rule for the domestic interest rate and the nominal floating exchange rate is effective in promoting non-inflationary economic growth for the Libya economy, subject to a Dutch disease oil price increase.

The world oil price shock and induced increase in fiscal spending need to be controlled by monetary policy. Two monetary policy instruments are required to break the trade-off between the two policy goals of higher real non-oil GDP and lower price level. This is done in the form of the monetary condition index of an extended Taylor rule, in which both the nominal interest rate and exchange rate are simultaneously determined in response to the world oil price shock. The Taylor rule is dynamically specified in terms of minimising the deviations of the growth in real non-oil GDP and the inflation rate from their respective target rates.

The six variable SVAR Taylor rule simulations show the shock to the growth in the world oil price increases growth in total real government spending and initially increases real non-oil GDP growth above target. These increases are limited to the short term, extending to over only a couple of periods. Surprisingly, this is not followed by the negative Dutch disease effect on growth of real non-oil GDP. It does not eventuate with its growth returns to the target rate in the short term, remaining there into the medium term. Importantly, inflation remains close to the target rate for the whole period. The reason for this breakdown in the trade-off is the dual use of monetary policy instruments via the Taylor rule. The nominal interest rate increases immediately, appreciating the nominal exchange rate. Both these responses control inflation. The exchange rate then depreciates back to its steady state to counter the negative effect on the growth in real non-oil GDP, which subsequently returns to its target growth rate. Once the system is stabilised, the nominal interest rate quickly reduces back to its steady state value in the short term. This evidence indicates that Hypothesis 3C cannot be rejected.

These dynamic simulations, based theoretically on the extended Taylor rule with a flexible nominal exchange rate and fiscal expenditure, provide a framework for short-term monetary policy to help overcome Dutch disease and ensure price stability in Libya.

The main conclusions of the dynamic simulations in Chapter 7 are first, that Libya needs to redirect fiscal expenditure away from consumption and towards strategic investment spending. This long-term strategy should aim to improve productivity in the non-oil sector and reduce inflationary pressure. Second, in the case of a world oil price shock, consistent with Corden (2012), the appropriate short-term fiscal response is that increased fiscal spending should be designed to reduce public consumption spending and move the fiscal budget towards a surplus. Third, a Taylor rule should be used as the basis of short-term monetary policy to limit the increase in the nominal interest rate and counter the appreciation of the flexible nominal exchange rate. This coordination of these instruments will reduce Dutch disease effects in the short to medium term, and help achieve stable prices.

8.3 Policy Implications

There are several policy implications that can be derived from the findings of this thesis. These will be summarised in three main policy considerations:

1. There should be a movement from the utilisation of a managed exchange rate to a flexible exchange rate.

2. A strategy to reduce the fiscal budget deficit should be implemented through the minimisation of government spending on consumption and an increasing focus on government spending on investment.

3. The government should strive to achieve a sound combination between fiscal and monetary policy, as provided in the Taylor rule. The results of the simulations of impulse responses have indicated that these policy considerations can contribute to mitigating the effects of Dutch disease and

improving key macro-economic consequences in terms of real output and domestic prices.

First, the main finding of this thesis generally indicates the importance of the exchange rate as a channel and as regimes, managed or flexible, in determining real output and domestic prices under world oil price shocks. In future, it would be more beneficial for the country to progress from a managed exchange rate to a flexible exchange rate. Moreover, with the managed exchange rate of Libya, the structural imbalances seem to be the key sources of higher domestic prices. With a flexible exchange rate regime, inflation appears to be a monetary phenomenon and not structural, and can be controlled through the adjustment of monetary policy instruments. Thus, moving to a flexible exchange rate is recommended by this study as a strategy to provide a better atmosphere for other policies, and is especially relevant in terms of making monetary policy more effective in promoting RNOGDP growth and reducing the adverse impact of Dutch disease.

Second, the response of fiscal policy to oil price shock uses unique channels with different exchange rate regimes. The key findings suggest that a fiscal budget surplus strategy minimises government spending for consumption, but not investment. This could be utilised as a strategy of fiscal policy to mitigate the adverse impact of Dutch disease. The key finding generates more benefits for the domestic economy in terms of the enhancement of infrastructure, private sector investment and non-oil output supply, and hence, sustainable economic development. This can offset the loss of international competitiveness arising from the strong appreciation of the exchange rate due to Dutch disease. This is a key recommendation of the study that highlights the importance of allocating oil revenue for investments rather than for consumption expenditure.

This strategy is in line with Corden's (2012) first recommendation to manage the Dutch disease. It is therefore essential for the government to create a sovereign wealth fund which would smooth this process by isolating a certain amount of the allocation of oil revenue for public saving in the form of overseas investment.

Third, since the fiscal policy promotes real output and its growth, and monetary policy is more related to controlling prices and inflation, the findings reveal that coordinating fiscal and monetary policies with a Taylor rule and a floating exchange rate is the preferred strategy to reduce the adverse impact of Dutch disease. These results support the 2003 IMF suggestion for Libya, which were published in the 2006 and 2008 *IMF Country Report*. They recommend that the country achieve greater coherence between fiscal and monetary policies for it to achieve higher economic growth and lower inflation.

8.4 Significance of the Research

The impacts of oil price shocks and their association with Dutch disease effects on an abundant-resource economy has been extensively studied for industrialised countries, but to a much lesser extent for developing countries (Cox & Harvie, 2010). While there have also been analyses of appropriate fiscal policy responses to Dutch disease effects, this has mainly focused on industrialised countries, not resource-abundant developing nations such as those in the MENA region. Moreover, the response of monetary policy to Dutch disease remains limited in the literature for all countries experiencing this phenomenon.

Therefore, the significance of this research is to develop a macro-economic model for a small, open, oil-exporting country like Libya, estimate it using Libyan data and simultaneous econometric techniques, simulate it to identify the dynamic responses of key macro-economic variables to oil price shocks, and provide guidance for appropriate fiscal, monetary and exchange rate policies responses to mitigate adverse Dutch disease effects. This is significant because it will provide unique and evidence-based policy prescriptions.[41] This study, although focusing on issues of relevance to the Libyan economy, has relevance to other oil-exporting countries in the MENA region, and other resource-exporting developing countries more generally.

[41] The traditional approach has simply focused on modeling the Dutch disease.

8.5 Suggestion for Future Research

There are three main aspects related to this study, which can be investigated in future studies. First, future research can investigate the fiscal surplus strategy explained in Chapter 6. Through a minimum consumption expenditure scenario, the focus should be on expenditure for investment, as discussed in Section 7.2. This can be examined in future studies of the creation of a sovereign wealth fund, as has been adopted in resource-developed nations such as Norway to mitigate Dutch disease and generate revenue through investments in developed countries. Research recommendations can suggest that government spending for consumption be reduced and focus on domestic and overseas investment through a sovereign wealth fund channel. Government domestic investment can improve supply aspects such as infrastructure and human capital (health and education), which would provide a solid foundation future growth of the country. The government, through the sovereign wealth fund channel, can undertake overseas investment. This approach would reduce any criticism that investment was being conducted solely to address future risk and not for the current benefit of the citizens. Oil revenue foreign reserves should largely be operated overseas. The extent to which the sovereign wealth fund channels can depreciate the exchange rate or increase its stability and reduce Dutch disease in the short and medium term, and the degree to which the fund could generate permanent revenue for a future generation when the oil is depleted, should be the subject of future research.

Second, an examination of a monetary transmission mechanism and policy guidance for financial sector development needs to be undertaken. This study investigates the two main channels of the monetary transmission mechanism of Libya—the interest and exchange rate—in the current undeveloped financial sector. Future research should investigate oil prices shock with an extended model of a monetary transmission mechanism by suggesting and designing a developed financial sector model to test the effects of the implementation of a developed monetary policy system. It could include the ability of central banks to be alert to the impact of the structural change to reduce the adverse impacts of Dutch disease on the domestic economy. Therefore, the extended model with an oil price shock and a developed financial sector would include four main ways in which monetary policy affects the economy: interest rate channel, credit channel, asset price channel (including financial wealth) and exchange rate channel to determine how these channels influence investment and consumption (aggregate demand) under an oil price shock and their effect on growth and inflation.

Third, it is imperative to investigate the combination of fiscal and monetary policies using different types and weights of the Taylor rule. This study investigates the combination of the fiscal and monetary policy of the Taylor rule. Future research could expand this scope by using more developed versions of the Taylor rule under different scenarios separately employing growth targets for real output, inflation, interest rate and exchange rate. This would serve as a model to target all to determine the best Taylor rule to achieve higher growth and lower inflation under oil price shocks. Policymakers in oil-exporting countries urgently need more policy options relating to the Taylor rule as a strategy to mitigate the adverse influences of the Dutch disease.

This issue and the sovereign wealth fund will also be considered in future studies by the researcher of this thesis.

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Appendices

Appendix 4

Table A4.1 *Mathematical Notation of the Theoretical Model*

Model Symbol	Description
No_t^d	demand for non-oil output
c_t^p	private consumption spending
i_t^p	private investment spending
g_t	government expenditure
$NTP_t = (x_t^n - m_t^n)$	balance of non-oil trade
$OTP_{t-i} = o_t^x - o_t^m$	balance of oil trade
$TNTP_{t-i} = NTP_{t-i} + OTP_{t-i}$	total balance trade
con_t^p	private consumption spending
No_t^s	non-oil output
w_t^p	private sector wealth
$\dot{k}_{t-i}^p$	private capital stock
No_t^s	real non-oil output
con_t^g	government consumption spending
$er = (e_t - p_t)$	real exchange rate
o_t^x	export of oil
po_t	price of oil
$r_t^* f$	foreign interest income
$bd_t = g_t - t^x$	budget deficit
M_t	real money balance
x_t^n	export of non-oil sector
y_t^{RI}	real (output) income
m_t^{con}	non-oil consumption imports
o_t^a	oil production
po_t	world prices of oil
$\mathrm{w}_{\mathrm{t}}^{\mathrm{r}}$	domestic nominal wage growth
$\mathrm{p}_t^{\mathrm{n}}$	price of non-oil imported good
M_t^d	demand for real money balances

r_t	domestic interest rate
π_t	domestic inflation
m_t^S	nominal money supply
dc_t	domestic credit
f_t	foreign exchange reserves
$No_t^{gap} = (No_t^d - No_t^s)$	output gap
π_t^e	inflation expectation
y_t^g	output target
π_t^g	target inflation
T_t^x	tax revenue
ε_t	shocks
con_t^g	government consumption spending
CA_t	current account balance
o_t^m	imports of oil sector
BP_t	balance of payments

Appendix 5

A5.1 Cointegration

Table A5.1 *Johansen Long Run Cointegrating Vectors*

	RGDP	RNOGDP	REXN	CPI	WROILP	Constant
Model 1	1.000	-	-0.226 (0.50)	+0.497*** (0.20)	-0.785*** (0.18)	-33.935
Model 2	-	1.000	-3.265*** (1.09)	-1.817*** (0.43)	+1.595*** (0.40)	+81.335

Notes: Standard errors are in parentheses.
*** significant at the 1% level ** significant at the 5% level * significant at the 1% level.

The short run error correction coefficients, shown in Table A5.2, have the correct signs for the significant estimates. The effects of REXN are of the wrong sign and whilst not significant, they will cause the VECM to diverge from long run equilibrium. The impulse response functions in Figures A5.1 and A5.2 show the opposite effects on the REXN with an increase in WROILP depreciating REXN for RGDP and appreciating REXN for RNOGDP. This is consistent with the long run results, but requires inconsistent and contradictory adjustments in REXN, providing permanent changes to new steady states. The possible mixed orders of stationarity for these variables may be affecting the short run and long run estimates and other methods will be considered in this study.

Table A5.2 *Johansen Short Run Error Correction Mechanisms*

	RGDP	RNOGDP	REXN	CPI	WROILP
Model 1	-0.211*** (0.06)	-	-0.036 (0.03)	-0.014 (0.03)	-0.007 (0.23)
Model 2	-	-0.336*** (0.09)	-0.018 (0.01)	0.027** (0.01)	-0.216*** (0.08)

Note: Standard errors are in parentheses.
*** significant at the 1% level ** significant at the 5% level * significant at the 1% level

Figure A5.1. Impulse response functions for model 1

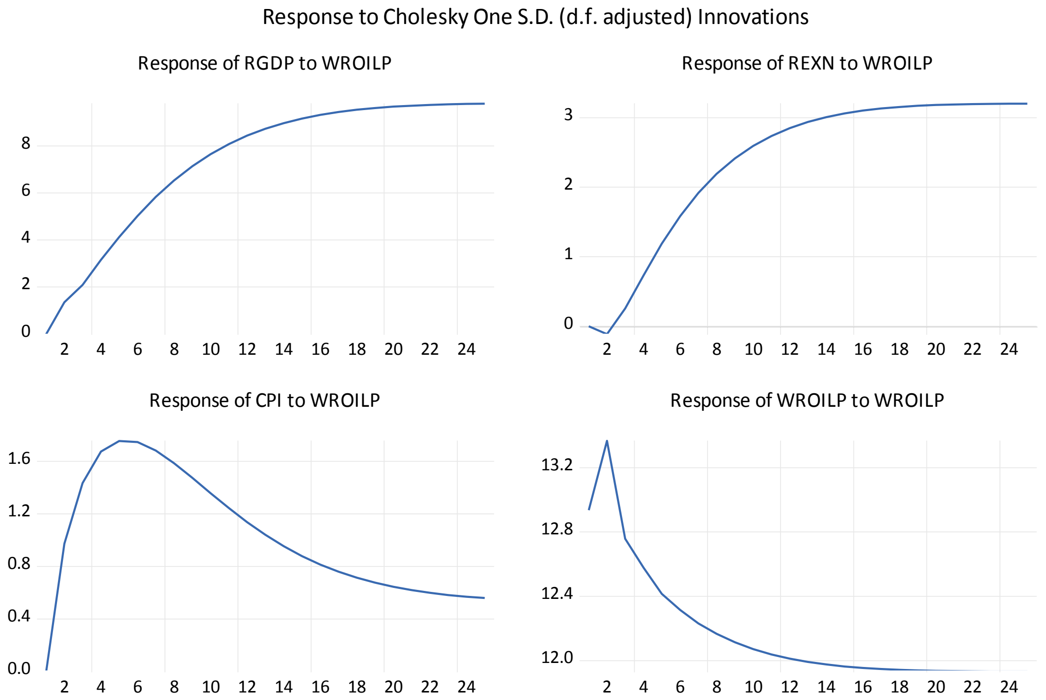
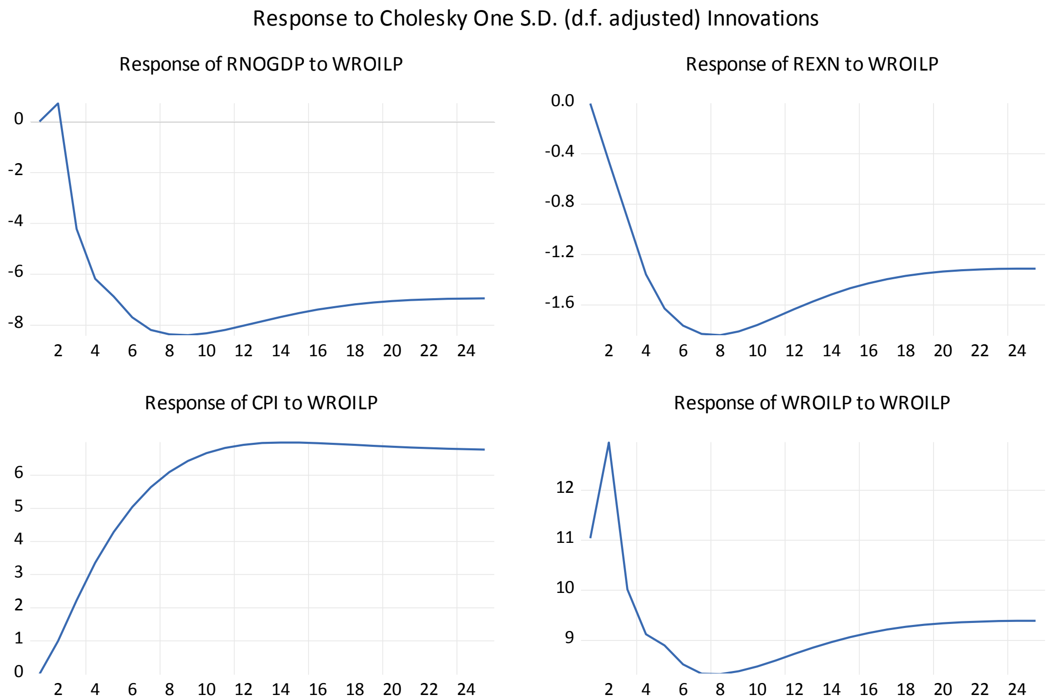


Figure A5.2. Impulse response functions for model 2



A5.2 SVAR in First Differences

Figure A5.3. SVAR impulse response functions for first differenced data - model 1

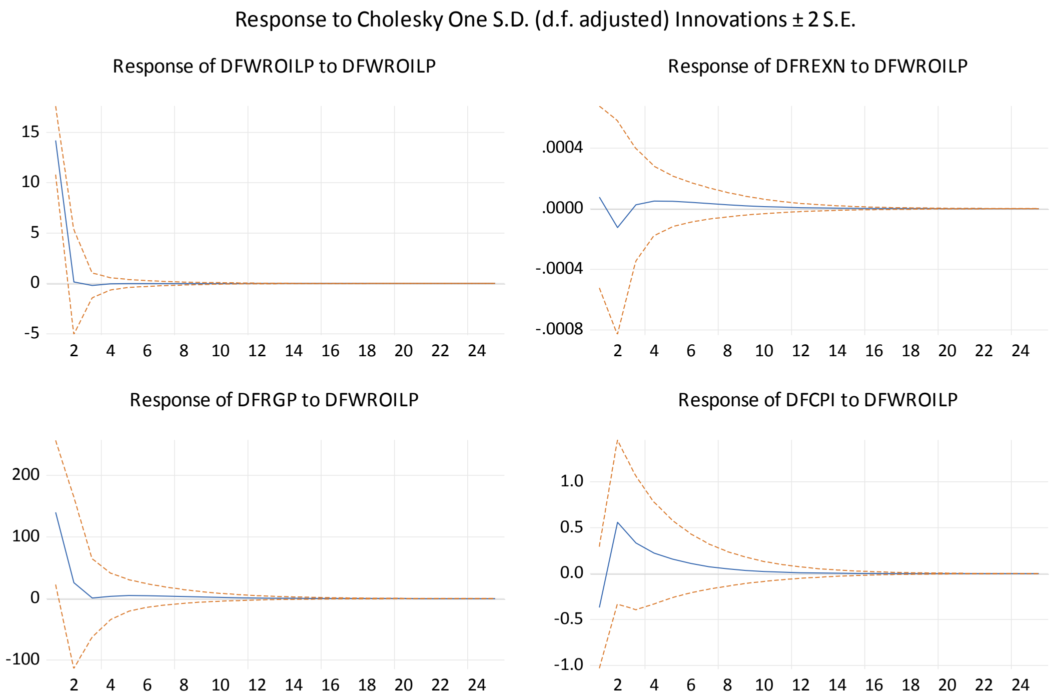
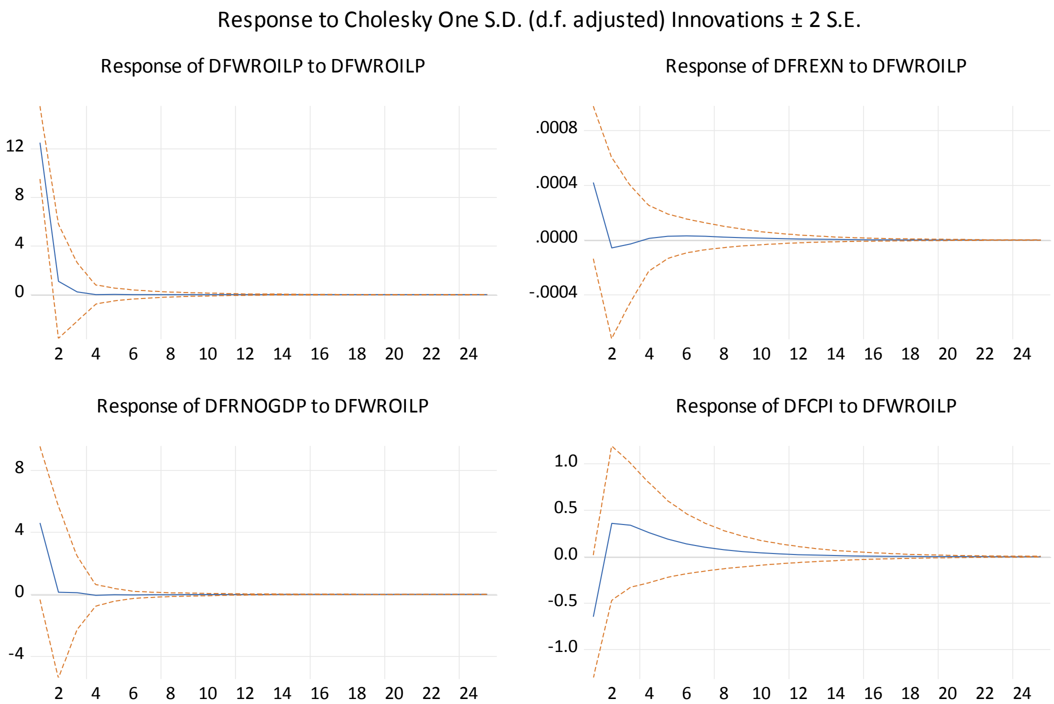


Figure A5.4. SVAR impulse response functions for first differenced data - model 2



A5.3: Estimates of VAR and SVAR

Table A5.3 *VAR Estimation for Model 1*

	WROILP	REXN	RGDP	CPI
WROILP(-1)	0.895***	-0.024	0.074***	0.079***
	(0.17)	(0.02)	(0.03)	(0.028)
REXN(-1)	-0.481*	0.984***	0.387***	-0.274***
	(0.30)	(0.05)	(0.11)	(0.06)
RGDP(-1)	-0.334*	-0.261*	0.769***	-0.014
	(0.206)	(0.191)	(0.07)	(0.045)
CPI(-1)	-0.005	0.061***	-0.080**	0.916***
	(0.184)	(0.013)	(0.035)	(0.032)
C	10.463	-0.483	0.173	10.313
	(14.02)	(1.73)	(4.16)	(2.44)
R-squared	0.83	0.98	0.97	0.99
Adj. R-squared	0.81	0.97	0.97	0.99
Sum sq. resids	5160.6	78.49	454.54	155.87
S.E. equation	12.9	1.59	3.83	2.24
F-statistic	39.06	336.36	299.12	2823.48
Log likelihood	-140.45	-65.11	-96.73	-77.46
Akaike AIC	8.08	3.89	5.65	4.58
Schwarz SC	8.30	4.12	5.87	4.80
Mean dependent	41.29	16.62	40.77	60.17
S.D. dependent	29.84	9.98	22.68	40.34

*Indicates coefficient significant at 10% level, ** significant at 5% level, *** significant at 1%. level

Table A5.4 *SVAR Estimates for Model 1*

Structural VAR is just-identified Z statistics

Estimated A matrix:			
1.000000	0.000000	0.000000	0.000000
- 0.014130*	1.000000	0.000000	0.000000
-0.112065***	-0.682894*	1.000000	0.000000
-0.017927	0.401721**	0.286986***	1.000000
Estimated B matrix:			
12.90244***	0.000000	0.000000	0.000000
0.000000	1.580820***	0.000000	0.000000
0.000000	0.000000	3.427995***	0.000000
0.000000	0.000000	0.000000	1.778254***

*Indicates coefficient significant at 10% level, ** significant at 5% level, *** significant at 1%. level

Table A5.5 *VAR Estimates for Model 2*

	WROILP	REXN	RNOGDP	CPI
WROILP(-1)	0.793***	-0.044***	-0.051	0.084***
	(0.139)	(0.016)	(0.134)	(0.023)
REXN(-1)	-0.347**	0.946***	0.781***	-0.260***
	(0.209)	(0.039)	(0.336)	(0.057)
RNOGDP(-1)	-0.207*	0.048***	0.188	-0.051*
	(0.126)	(0.021)	(0.179)	(0.031)
CPI(-1)	0.174*	0.050***	0.116	0.918***
	(0.107)	(0.016)	(0.132)	(0.023)
C	-3.454	-1.762	-7.693	9.868
	(9.706)	(1.107)	(9.329)	(1.598)
R-squared	0.83	0.98	0.31	0.99
Adj. R-squared	0.81	0.97	0.22	0.99
Sum sq. resids	5302.3	68.9	4897.5	143.85
S.E. equation	13.08	1.49	12.57	2.15
F-statistic	37.81	383.80	3.48	3060.23
Log likelihood	-140.94	-62.78	-139.53	-76.02
Akaike AIC	8.11	3.77	8.03	4.50
Schwarz SC	8.33	3.98	8.25	4.72
Mean dependent	41.29	16.62	13.17	60.17
S.D. dependent	29.84	9.98	14.24	40.34

*Indicates coefficient significant at 10% level, ** significant at 5% level, *** significant at 1%. level

Table A5.6 *SVAR Estimates for Model 2*

Estimated A matrix:			
1.000000	0.000000	0.000000	0.000000
-0001920*	1.000000	0.000000	0.000000
-0.379973***	-0.009376*	1.000000	0.000000
0.008832*	0.474665***	0.009122	1.000000
Estimated B matrix:			
13.07835***	0.000000	0.000000	0.000000
0.000000	1.491792***	0.000000	0.000000
0.000000	0.000000	11.54509***	0.000000
0.000000	0.000000	0.000000	2.025276***

*Indicates coefficient significant at 10% level, ** significant at 5% level, *** significant at 1%. level

A5.4 Stability Analysis

The inverse roots of the characteristic polynomial (Lutkepohl 1991), for models 1 and 2 are reported in Table A5.7. The moduli are all less than one indicating the VARs for models 1 and 2 are stable. These results support the previous discussion of leaving the variables in levels for the VAR, rather than first differencing them.

Table A5.7 *VAR Stabilty Test*

Model 1	
Root	Modulus
0.950 – 0.079i	0.953
0.950 + 0.079i	0.953
0.831- 0.209i	0.857
0.831 + 0.209i	0.857
Model 2	
0.928 – 0.066i	0.931
0.928 + 0.066i	0.9306
0.849	0.849
0.139	0.139

Appendix 6A

Table A6.1 *VAR Stabilty Test of 6A Mode*l

Root	Modulus
0.99	0.99
0.81 - 0.17i	0.82
0.81 + 0.17i	0.82
0.65	0.65
0.12 - 0.30i	0.32
0.12 + 0.30i	0.32

Table A6.2 *SVAR Estimates for 6A Model*

Estimated A matrix:					
1.00	0.00	0.00	0.00	0.00	0.00
2.665**	1.00	0.00	0.00	0.00	0.00
-0.239**	0.0069*	1.00	0.00	0.00	0.00
-0.263*	0.318***	3.721	1.00	0.00	0.00
-5.133**	2.973*	6.563**	0.295**	1.00	0.00
0.027	-0.0058*	-0.299***	0.0027*	-0.00028	1.00
Estimated B matrix:					
13.134***	0.00	0.00	0.00	0.00	0.00
0.00	108.63***	0.00	0.00	0.00	0.00
0.00	0.00	4.0067***	0.00	0.00	0.00
0.00	0.00	0.00	79.022***	0.00	0.00
0.00	0.00	0.00	0.00	11.25***	0.00
0.00	0.00	0.00	0.00	0.00	2.106***

Appendix 6B

Table A6.3 *VAR StabiltyTest of 6B Model*

Root	Modulus
0.94	0.94
0.87 - 0.22i	0.90
0.87 + 0.22i	0.90
0.84	0.84
0.60 - 0.27i	0.65
0.60+ 0.27i	0.65
-0.17	0.17

Table A6.4 *SVAR Estimates Model of 6B*

Estimated A matrix:						
1.00	0.00	0.00	0.00	0.00	0.00	0.00
0.014*	1.00	0.00	0.00	0.00	0.00	0.00
-0.045**	1.870**	1.00	0.00	0.00	0.00	0.00
-0.004	0.389	0.017*	1.00	0.00	0.00	0.00
-0.014*	0.00	0.004**	-0.019	1.00	0.00	0.00
0.060*	0.00	-0.019	0.006	0.00	1.00	0.00
0.0167	-0.0116*	-0.025*	-0.241***	-0.029*	0.065**	1.00
Estimated B matrix:						
11.53***	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1.56***	0.00	0.00	0.00	0.00	0.00
0.00	0.00	8.85***	0.00	0.00	0.00	0.00
0.00	0.00	0.00	2.14***	0.00	0.00	0.00
0.00	0.00	0.00	0.00	1.054***	0.00	0.00
0.00	0.00	0.00	0.00	0.00	2.523***	0.00
0.00	0.00	0.00	0.00	0.00	0.00	1.139***

Appendix 7

A7.1 Residual Based Tests of Fiscal Policy Cases A and B Under Flexible Exchange Rate

Table A7.1.1 *VAR Lag Order Selection Criteria for Case A* (*Increased Government Consumption Expenditure*)

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-2021.48	NA	1.99e+39	116.03	116.43	116.17
1	-1764.59	366.9	9.92e+34	105.98*	109.98*	107.36
2	-1550.39	195.8*	1.37e+32*	98.37*	105.96*	100.99*
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA

Notes: Sample: 1 37 (1980–2016) Included observations: 35.
* indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table A7.1.2 *Residual Serial Correlation Test for Case A* (*Increased Government Consumption Expenditure)*

Lags	**LM-Stat**	**Probability**
1	92.75	0.09
2	45.78	0.58
3	131.37	0.00
4	104.43	0.04

Note: Sample: 1 37 (1980–2016). Included observations: 36.
Probabilities from Chi-square distribution with 81 degrees of freedom.

Table A7.1.3 *VAR Lag Order Selection Criteria for Case B* (*Increased Government Investment Expenditure*)

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-1820.3	NA	2.02e+34	104.5	104.9	104.6
1	-1557.2	375.85*	7.09e+29	94.12	98.13*	95.5
2	-1387.17	155.48*	1.22e+28*	89.04*	96.64*	91.66*
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA

Notes: Sample: 1 37 (1980–2016) Included observations: 35.
* indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table A7.1.4 *Residual Serial Correlation Test for Case A* (*Increased Government Investment Expenditure)*

Lags	**LM-Stat**	**Probability**
1	94.53	0.14
2	101.01	0.06
3	171.58	0.00
4	114.32	0.008

Note: Sample: 1 37 (1980–2016). Included observations: 36.
Probabilities from Chi-square distribution with 81 degrees of freedom.

Table A7.1.5 *VAR Stabilty*

Model A	
Root	**Modulus**
0.913 - 0.071i	0.915
0.913 + 0.070i	0.915
0.818 - 0.285i	0.866
0.818 + 0.285i	0.866
0.468 - 0.086i	0.476
0.468+ 0.086i	0.476
-0.200 - 0.332i	0.388
-0.200 + 0.332i	0.388
0.034	0.034
Model B	
0.935 - 0.0902i	0.939
0.935 + 0.0902i	0.939
0.789 - 0.350i	0.864
0.789 + 0.350i	0.864
0.370- 0.177i	0.4105
0.370 + 0.177i	0.4105
-0.352	0.352
0.061 - 0.323i	0.328
0.061 + 0.323i	0.328

A7.2 Estimates of the SVAR

Table A7.2.1 *SVAR Estimates for Model of Case A*

Z statistics

Estimated A matrix:								
1.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.1029	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-0.624***	0.004***	1.00	0.00	0.00	0.00	0.00	0.00	0.00
-1.77***	0.244	0.5523***	1.00	0.00	0.00	0.00	0.00	0.00
-1.124	0.003	0.390**	0.00	1.00	0.00	0.00	0.00	0.00
0.0340**	0.000	0.000	0.002	-0.07	1.00	0.00	0.00	0.00
-5.625	0.001**	-1.484***	-0.148***	1.305**	0.039**	1.00	0.00	0.00
0.307**	0.006	-0.096*	0.0002	0.109**	0.003	0.002	1.00	0.00
0.008	0.003	0.069**	0.009	0.044**	0.004	0.0001	-0.220***	1.00
Estimated B matrix:								
12.18***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	2757.8***	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	31.19***	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	4597.9***	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	29.71***	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	76.63***	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	714.51***	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.180***	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.14
Log likelihood	-1894.196							

Table A7.2.2 *SVAR Estimation for Model of Case B*

				Z statistics				
Estimated A matrix:								
1.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.52**	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-0.071	0.002**	1.00	0.00	0.00	0.00	0.00	0.00	0.00
0.116	-0.0013***	-0.063	1.00	0.00	0.00	0.00	0.00	0.00
- 0.981**	-0.0009	0.204	0.00	1.00	0.00	0.00	0.00	0.00
0.0117	0.00	0.00	0.331***	0.25	1.00	0.00	0.00	0.00
0.015	0.022	-1.621***	4.62***	6.7	0.015	1.00	0.00	0.00
0.29**	0.0009*	-0.050	0.003	-0.11***	-0.004	0.00012	1.00	0.00
0.072	0.0006	0.060***	0.033	0.056***	0.0061	-0.00017	-0.23***	1.00
Estimated B matrix:								
11.48***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4988.37***	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	32.34***	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	8.37***	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	30.09***	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	69.46***	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	794.61***	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.080***	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.03***
Log likelihood	-1686.676							

A7.3 Residual Based Tests of Fiscal Policy and Monetary Policy Combination Model Under Flexible Exchange Rate

Table A7.3.1 *VAR Lag Order Selection Criteria*

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-1136.31	NA	2.55e+22	71.46	71.7	71.56
1	-941.35	292.44*	3.00e+18	62.33	64.91*	63.18
2	-880.18	64.9	2.27e+18*	61.57*	66.38	63.17*
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA

Notes: Sample: 1 37 (1980–2016) Included observations: 32.
* indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table A7.3.2 *Residual Serial Correlation Test*

Lags	**LM-Statstic**	**Probability**
1	59.32	0.16
2	55.78	0.23
3	51.84	0.36
4	70.99	0.02

Note: Sample: 1 37 (1980–2016). Included observations: 36.
Probabilities from Chi-square distribution with 49 degrees of freedom.

Table A7.3.3 *VAR Stabilty Test*

Root	Modulus
1.01	1.01
0.873 - 0.281i	0.917
0.873+ 0.281i	0.917
0.899	0.899
0.4676	0.467
0.442	0.442
-0.283	0.284

A7.4 Estimates of the SVAR Fiscal Policy and Monetary Policy Combination Model Under Flexible Exchange Rate

Table A7.4.1 *SVAR Estimates*

Z statistics

Estimated A matrix:						
1.000	0.00	0.00	0.00	0.00	0.00	0.00
1.745	1.00	0.00	0.00	0.00	0.00	0.00
-9.28	-5.69***	1.00	0.00	0.00	0.00	0.00
0.311**	0.00	0.0019*	1.00	0.00	0.00	0.00
1.049	0.00	0.132	0.00	1.00	0.00	0.00
0.028	0.0003*	0.0003	0.062	0.00	1.00	0.00
-0.003**	-0.000392	0.0007	-0.004**	0.000425	-0.000873*	1.00
Estimated B matrix:						
10.83976	0.00	0.00	0.00	0.00	0.00	0.00
0.00	108.7026	0.00	0.00	0.00	0.00	0.00
0.00	0.00	31.19***	0.00	0.00	0.00	0.00
0.00	0.00	0.00	4597.9***	0.00	0.00	0.00
0.00	0.00	0.00	0.00	29.71***	0.00	0.00
0.00	0.00	0.00	0.00	0.00	76.63***	0.00
0.00	0.00	0.00	0.00	0.00	0.00	714.51***
Log likelihood	-1079.790					

A7.5 Impulse Response Functions of Macroeconomic Factors to Nominal Money Supply Shock

Figure A7.5.1. Money supply shock

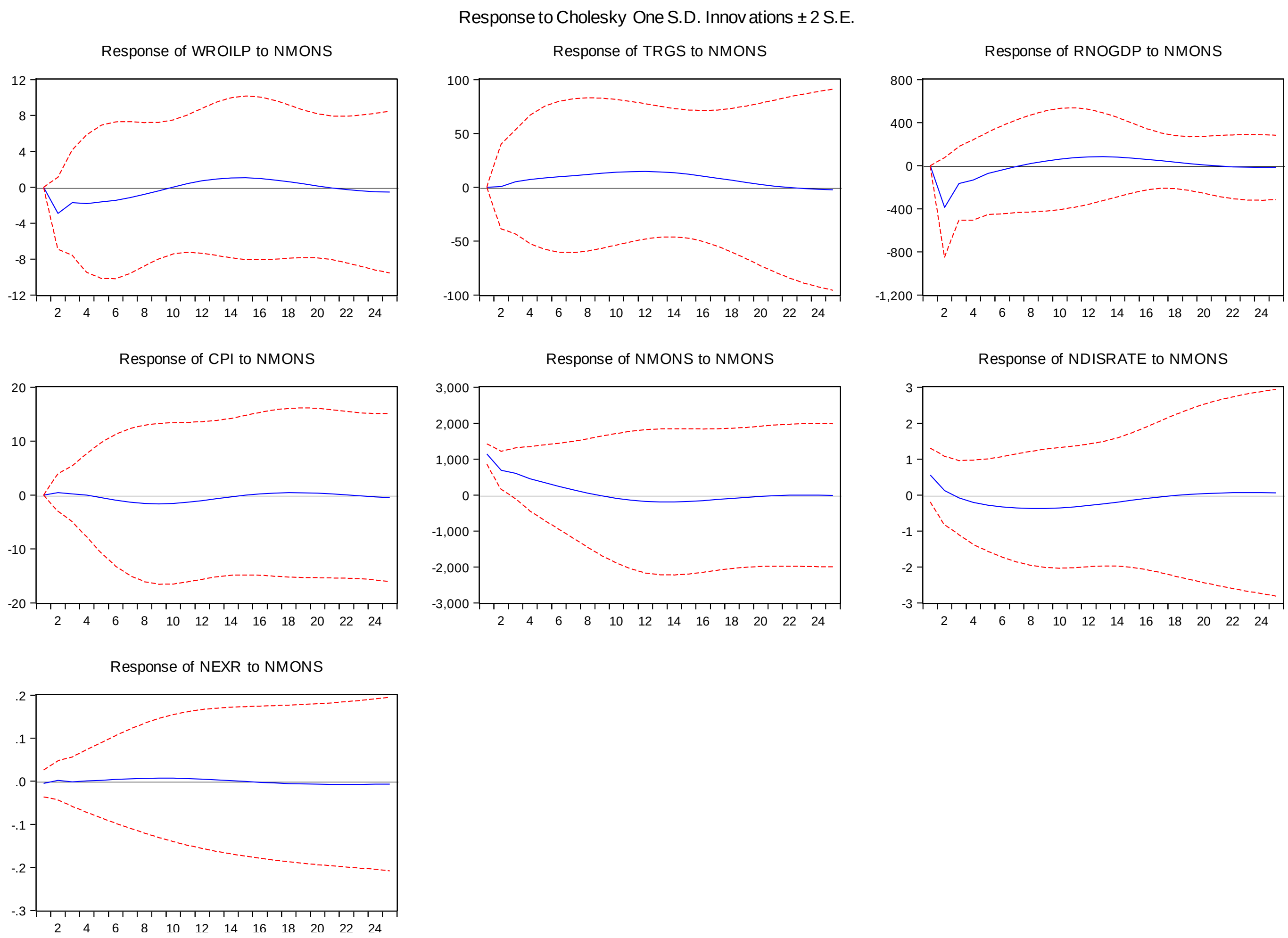


Figure A7.5.1 shows no significant responses to the variables from a shock to the nominal money supply.

A7.6 Taylor Rule Model

Table A7.6.1 *VAR Lag Order Selection Criteria for Taylor Rule Model*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-464.0138	NA	2.27e+10	40.87076	41.16698	40.94526
1	-369.8375	131.0279*	1.62e+08	35.81196	37.88547*	36.33344
2	-316.2216	46.62250	76735497*	34.28014*	38.13095	35.24861*
3	NA	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA	NA

Notes: Sample: 1 37 (1980–2016) Included observations: 35.
* indicates lag order selected by the criterion, LR: sequentially modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

Table A7.6.2 *Residual Serial Correlation Test for Taylor Rule Model*

Lags	**LM-Stat**	**Probability**
1	33.26	0.59
2	34.51	0.54
3	43.35	0.19
4	52.79	0.04

Note: Sample: 1 37 (1980–2016). Included observations: 36.
Probabilities from Chi-square distribution with 49 degrees of freedom.

Table A7.6.3 *VAR Stabilty Test*

Root	Modulus
1.070	1.070
0.809	0.809
0.601	0.601
-0.348 + 0.381i	0.516
-0.046	0.046
-0.348 - 0.381i	0.516

Table A7.6.4 *Estimates of the SVAR of Taylor Rule Model*

		Z statistics			
Estimated A matrix:					
1.000	0.00	0.00	0.00	0.00	0.00
0.198	1.00	0.00	0.00	0.00	0.00
-0.373	0.00	1.00	0.00	0.00	0.00
-0.0057	0.133***	0.0054*	1.00	0.00	0.00
-0.0037**	-0.008	-0.0022	-0.0483*	1.00	0.00
0.0008	0.000801	0.0010***	0.0074***	-0.068***	1.00
Estimated B matrix:					
25.8***	0.00	0.00	0.00	0.00	0.00
0.00	20.57***	0.00	0.00	0.00	0.00
0.00	0.00	78.82**	0.00	0.00	0.00
0.00	0.00	0.00	4.42***	0.00	0.00
0.00	0.00	0.00	0.00	0.64***	0.00
0.00	0.00	0.00	0.00	0.00	0.058 ***
Log likelihood	-416.8643				